The Electrical Review

VOL. LXXVIII. No. 1998. [All Rights Reserved.] MARCH 10, 1916. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 22, Rue de la Banque. Telegraphic Address: "Ageekay, London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

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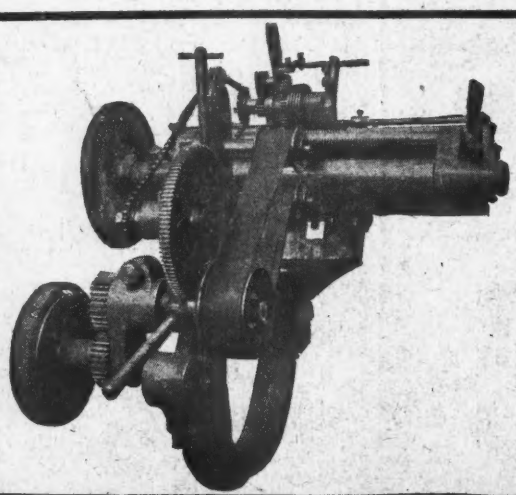

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ELECTRICAL REVIEW.

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 16s.

FOREIGN AGENTS:

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IN THE MELTING POT.

IN discussing the subject of organisation in our last issue we touched upon a number of ways in which our national industries may be strengthened by effort from within themselves. While that article was being written a number of leaders to whom we look for a certain amount of direction in these days, were delivering speeches in London on another and by no means less important aspect of the great question of after-the-war trade. We do not agree that discussion of such matters in any degree weakens the nation's effort to speedily bring the war to a victorious conclusion, and we are glad that two very busy members of the Cabinet were able to find time to attend part of the proceedings of the Association of Chambers of Commerce for the purpose of making speeches concerning the relation of trade to the war and the essential nature of the service that traders are rendering to the Empire and the Allies, also to reveal, though only in some small way, what is happening in the minds of members of the Government respecting what assistance the nation should render to industry after the war. Mr. McKenna, the Chancellor of the Exchequer, and Mr. Bonar Law, the Colonial Secretary, a few years ago might not have been credited with the desire to sleep in the same bed, but their presence in the same Cabinet in a period of national crisis, and the consciousness that the position that now confronts us is totally different from any that we have ever known before, have led them to turn their swords into ploughshares, and they are together preparing the ground for a compromise respecting what they formerly regarded as vital differences. Mark first the words of Mr. McKenna:—"We must learn by the experience of the past. . . . We have found ourselves dependent upon that nation (Germany) for many essential matters of our own trade. I do not think that, as a nation, whether by the individual efforts of our traders or with the necessary assistance of Government, we ought ever to allow ourselves to be placed in that position again." He proceeded to show that there was a very large field for common agreement between those who still stood for or against certain principles, but he added what we have said on many occasions: "It does not follow, though trade may be free, that the help of the Government should not be given to assist our traders." Our regret is that the Government did not see it so in days gone by and render a greater measure of assistance, but, as Mr. McKenna says, the Government has learned "by the experience of the past," and it is now about to act. What is to be the course of that action? The most significant and hopeful part of the speech, though somewhat enshrouded in mystery, was this:—

"We are prepared, and we have already shown, in a way which I am not yet able to state to you, that we are prepared to give the assistance of the Government to the development of foreign trade in order to ensure that those rivals who are now our bitter enemies, shall not have the control of the foreign trade which they have enjoyed in the past. . . . In the past there has been some complaint that Government has not given that assistance in distant parts of the world which was rendered by other Governments in similar circumstances. Well, it may be that a policy which is right at one time is not right at another, and it may be that we have to learn that a policy of Government assistance becomes necessary to secure the development of what we might term the master trades, and to secure the extension of our commercial influence through neutral countries."

Here we must leave the Chancellor. We must not venture to probe the inner recesses of the governmental brain, though we confess that we shall await with pleasure the further draught which is so necessary to satisfy our thirst for information.

The attitude assumed by the Colonial Secretary on the following day is in marked similarity to that of Mr. McKenna. "Everything is changed," said Mr. Bonar Law. He is not arguing to convert Manchester electors now, all that is a matter of the dead past—"Everything is changed. We must begin on a new basis; we must put aside all preconceived ideas . . . . the problem is not at all the same as we used to discuss, and it must be considered from a new point of view by those who held my views and those who were opposed to them." The probability that after the war there will be special trade relations between those who are now our Allies "completely alters the basis of the problem." As Colonial Secretary he turned from the question of trade with the Allies to the future of our trade within the Empire. "Whether it pays us or not we shall not forget these things (war horrors), and whatever else happens the resources of the British Empire will never again be exploited as in the past by our German enemies." Further, "I do not believe that the people of this country will be satisfied with any system which makes us dependent for the key industries of our trade and for our supplies for war on any nation, least of all on the German nation." We shall all desire to re-echo the tributes which Mr. Law paid to the magnificent service rendered by the Colonies throughout the war. "We could not have won this war, we could not win it now, but for the strength which we have got from the great Dominions." In presence of such a conviction, after the utterance of so momentous a statement, there will surely be none to deny the Dominions a voice in regard to what the after-the-war policy of the Empire shall be, and in that policy the question of trade and industry occupies a large place. Some of the Colonies are already dealing with the matter, so far as they can, endeavouring to exclude German influence both now and after the war. Mr. Andrew Fisher and Mr. Hughes are now in this country. They are both highly charged with messages from the Australian people urging that we adopt no half-hearted measures which will permit of cancerous growth again occurring in vital industries of the British Empire. Mr. Law had all of these circumstances in mind when he said that the problem of the future must be considered in conjunction with the great Dominions as well as in conference with our splendid Allies. He announced that arrangements were being made for an economic conference of the Allies to be held in Paris, at which will be considered both the fuller use of the economic forces of the Allies in the prosecution of the war itself, and the problem of what will happen after the war, when Russia and Italy want to be free from the influence with which German financiers and business men have permeated their industries in recent years. Mr. Bonar Law confessed that he could not fix his mind on "after-the-war" problems at that meeting, and so much depends upon the conference at Paris, that Mr. Asquith on Tuesday was in the same position. As a matter of fact, we all feel how immense these problems are, and how vast will be the attention that they will have to receive before the details can be settled point by point, but apart from the consideration of the details, we can find a common ground in the speeches of these dissimilar men—a definite desire for, and a move in the direction of, a compromise which will bury the controversies of the past and lead us all to adopt some policy or other which shall enable the Home Country, the Empire, and the Allies, so to act in harmony for generations to come as to bring happiness and prosperity, and freedom from external menace, to all the nations that have been so terribly mangled in their efforts to prevent the domination of the world by Prussian militarism. As there will be no separate Peace, so will there be no separate commercial treaties made with the Enemy, by any one of the Allies. The prospect of an Economic Pact is already giving German traders "furiously to think."

One other speech delivered last week has a close relation to the two referred to above—we mean that of Sir E. Holden, who also appeared before the Chambers of Commerce gathering. His remarks were devoted to the subject of banking, and in our efforts to secure the co-operation of the banks in assisting our industrial development we shall do well to keep his speech in mind. We believe that at heart most people share his admiration for the excellent work that British banks have rendered in the past. It is obvious from his speech that he urges British traders and industrial men to pursue the idea of forming, with the assistance of the Government, a big "additional" banking institution, perhaps on the familiar industrial bank lines, with branches or allied small banks in different countries abroad. By establishing such an organisation Sir Edward holds that "we should be pretty successful in turning the tables on our German banking competitors in foreign countries."

Copper. THERE has been no great change in fundamental conditions in copper within the last few weeks, although events in all metals have been the subject of the closest attention on the part of the authorities, whose efforts for some time were directed towards the elimination of gambling operations in the metals more particularly required for munition work. Although a warning to that effect had already been given recently in the case of pig-lead, the drastic action taken last week to prohibit speculation in war metals as indicated by the Proclamation came rather as a surprise, and naturally caused some consternation in metal circles, because of its far-reaching effects, also having regard to the difficulties involved in conducting *bonâ fide* business. Official dealings in copper, as in other metals, barring tin, which was excluded from the Proclamation, were brought to a standstill. Through the representation made to the Ministry of Munitions by a deputation from the Metal Exchange, however, a satisfactory understanding, was arrived at by which it was possible to resume official operations on the Metal Exchange on Monday last. These operations, of course, are now proceeding under the new regulations, or in accordance with the spirit of the Proclamation intended to prohibit speculation with no intention of interfering with the course of legitimate business. A more comfortable feeling has thus been brought about, although the liquidation of outstanding speculative engagements has now to be proceeded with. So far as copper is concerned, the modified aspect of the London official trading can hardly have any important bearing on the course of the general market under present exceptional conditions of scarcity due to the magnitude of the outlet not only in connection with the huge requirements of munition factories in warring nations, but also to the phenomenal extension of industrial enterprise across the Atlantic. There is no blinking the fact that these two factors combined have been for some time past more than sufficient to take care of the whole of the world's output in spite of the considerable increase in the American production to new high records. The American brass industry is now consuming much heavier quantities, the melting of the American Brass Co. alone being at the present time roughly estimated to be at the rate of well over ¼ million tons per annum. There has been, too, a notable expansion of electrical enterprise in the United States, partly in connection with important schemes of railway electrification. Very large quantities of copper have been shipped from America to the Allies in the last few months, but these appear to be rapidly swallowed up by the intense pressure of munition work, while it is rather significant that the unsold warehouse stocks of raw and finished metal in this country have been reduced to vanishing point. Sulphate makers now find considerable difficulty in covering their needs in rough bar copper, while the

demand for this material has been very keen at the relatively low prices ruling as compared with the value of American fine copper in the neighbourhood of £136. At the highly inflated level of prices at which their copper has been selling for some time past, American producers have been accumulating enormous profits, and this is not unlikely to continue so long as the war lasts. The bulk of their output has been sold for months ahead, therefore enabling them to be quite independent of adverse movements in the price of standard copper, such as have again been experienced lately amidst the disturbed surroundings. The market is admittedly held at a dangerously high level, but it is hardly likely that American control will be relaxed in view of the present exceptional opportunities.

The I.E E. and Alien Enemy Members.

The special meeting which was held last week to "consider" this question presented many unexpected features, not only to the Council and members of the Institution, but also to the interested onlooker. The large and punctual attendance of members at 5 o'clock was in itself surprising, and the intensity of feeling evinced in the course of the proceedings bore additional testimony to the importance attached to the question by them; moreover, the attendance was by no means confined to members resident in the London area—many well-known engineers had come to town expressly to take part in the proceedings. It is easy to understand, therefore, their disappointment when they found that, under the stress of "legal technicalities," it was not competent for them to propose and discuss amendments to the resolution which had received the sanction of the Board of Trade. As we pointed out some weeks ago, a fortnight's notice must be given of the nature of the business to be transacted at a special general meeting, and as barely a fortnight intervened between the calling of the meeting and the date on which it was to be held, it was obviously impossible for members to take any effective action towards varying the terms of the resolution.

Writing after the event, no doubt it is easy to reproach the Council for lack of foresight in approaching the Board of Trade first and the members afterwards; in the absence of a similar experience we might hesitate to criticise the Council on this ground. It happens, however, that the sequence of events closely resembles the procedure which was followed by the Council in 1911, when one week's notice was given of a meeting at which alterations in the Articles of the first importance were to be "considered," with the result that the members claimed their right to a voice in their own affairs, the meeting became a fiasco, and the whole question had to be reopened. The present Council cannot have forgotten those incidents, and, therefore, criticism is justified. On that occasion, writing before the meeting took place, we pointed out that the whole proceeding had an air of precipitation and autocracy, and that the wiser course would have been to allow plenty of time for mature consideration of the new proposals; precisely the same remarks apply to the present situation.

We have no doubt that the wisest course, under the circumstances, was that which was ultimately decided upon—namely, to consult the members first and the Board of Trade afterwards. This is also the routine that would be dictated by common sense, and why it was not adopted in the first instance we are at a loss to understand.

American Lamp Patents.

Those of our readers who recall the circumstances which attended the establishment of the Edison & Swan patents for carbon-filament lamps in this country, and their overthrow in Germany, will be interested to learn of the situation which has now arisen with regard to the tungsten lamp patents of Just & Hanaman. In December last we recorded the judgment of the Court of Appeal, according to which the judgment of Mr. Justice Joyce (that the plaintiffs' patent was not for making filaments of tungsten, but only for making them by the particular process specified) was substantially confirmed, the judgments of both tribunals being directed entirely to the process and not to the material used. The result of the action, subject to appeal to the House of Lords, is at present to throw open the manufacture of tungsten filaments of the "squirted" type in this country, for the process employed for this purpose by the defendants, which was declared not to be an infringement of the plaintiffs' patent, is, we believe, unprotected by letters patent.

On the other hand, we have just received particulars of the decision of the United States District Court, Southern District of New York, in an action brought by the General Electric Co. (U.S.A.) against the Laco-Philips Co., to restrain the latter from infringing the American patent of Just and Hanaman. The defendant company imported into the United States lamps with "squirted" and drawn-wire filaments of tungsten. The U.S. patent specification contained a broad claim for an incandescent lamp filament consisting of tungsten in a coherent metallic state and homogeneous throughout.

The Judge held that the lamps imported by the defendant company infringed the claims of the patent, and he also declared the patent valid. The application was filed in 1905, but the issue was delayed through interferences between four parties, one of whom, with the connivance of one of the Patent Office examiners, had fraudulently introduced into one of his own specifications matter derived from the Just & Hanaman application. In the end, priority of invention was awarded to Just & Hanaman, and the patent was issued on February 27th, 1912, so that it will run until 1929, and if the decision stands, the control of the tungsten lamp situation in the United States will until that date be entirely in the hands of the General Electric Co. and its licensees.

A striking feature of the decision is the fact that the claim of the American patent *for a product and not a process* (though two processes were described in the specification) has been upheld by the U.S. Court, while in this country the whole question turned upon the process and not upon the product.

Repairs to Street Mains and the Law of Negligence.

The case of Crane *v.* South Suburban Gas Co., which is reported in a recent number of the *Law Reports*, draws attention to an important point relating to the liability of gas and electric lighting companies whose mains must be repaired *in situ*. Workmen employed by the defendants, a gas company, for the purpose of carrying out repairs to a gas main in a highway, placed a fire pail, on which was a ladle containing molten lead, on unenclosed land adjacent to the highway. The plaintiff, a young child, was playing with other children near the fire when a passer-by accidentally knocked over the fire pail, and the molten lead was spilled on the plaintiff, causing her injury. In an action by the plaintiff to recover damages, the County Court Judge found that the defendants were guilty of negligence in leaving the fire unattended and unguarded with the knowledge that it was surrounded by children and that it was being used for molten lead. In these circumstances two Judges of the King's Bench Division have held that there was evidence on which the County Court Judge could find that the defendants were negligent, and that the defendants were also liable on the ground that what they were doing was a nuisance in that it was dangerous unless precautions were taken to guard persons using the highway from the danger. It is to be observed that the decision was based partly upon the fact that to melt lead in a place situate near a highway was a nuisance for which the defendants were liable if it caused damage. It is clear, therefore, that whenever street repairs are undertaken, the electrical employés should be warned to take the utmost care to keep the melting lead out of harm's way. In effect they are bound to insure the public against any injury which may happen.

THE RENAISSANCE OF THE LOW-TENSION FUSE.

By JOHN A CRABTREE.

When, if ever, the history of electrical switchgear comes to be written, it will be found that the last six years mark the "Renaissance of the Low-Tension Fuse." For some time prior to 1910, the general quality of low-tension switchgear had been steadily on the decline in this country. Mechanical strength and electrical efficiency had both been sacrificed for price, with the result that much of the switchgear sold at that time was flimsy, unreliable, and dangerous to operate. An examination and comparison of the average switchgear catalogue of 1909 and to-day, however, will show a remarkable difference and improvement in fuses and fuseboards. In the writer's opinion, this improvement is not merely due to the ordinary processes of evolution, but rather to the compelling forces of the Home Office Regulations governing the use of electricity in factories. Mr. Scott Ram's memorandum (Form 928, 1910) has also had no slight part to play in this development.

It is significant that though the Draft Regulations were published in 1907, and the approved Regulations at the

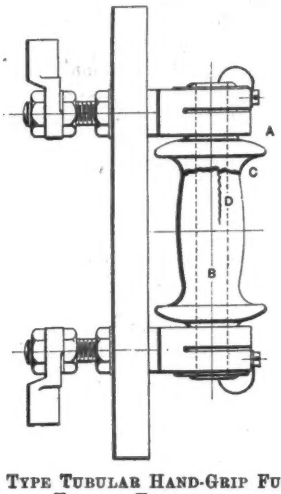

Fig. 1.—Old Type Tubular Hand-Grip Fuse, showing Typical Fracture.

end of 1908, nothing of any importance was done in the development of the "Home Office" type of fuse, until after the publication of the memorandum in February, 1910.

Prior to 1910, the tubular porcelain fuse of the hand-grip type, as fig. 1, was generally considered to be *the* thing in this country. In various forms, with differing ends and contacts of weird and wonderful design, it was almost universally adopted. It was a good fuse, infinitely preferable to the fuses it followed, but dangerous to handle, and with distinct limitations. The year 1910 marked its passing, or to be more exact, its development into the new fuse.

At first, manufacturers were slow to appreciate the position. A few, bolder than the rest, led the way and placed new designs on the market, and in 1910, at least six patents were taken out, on fuses specially designed to comply with the regulations and memorandum. These designs being based on the "safety first" principle, were naturally more expensive than the old-fashioned types, and therefore inclined to be slow sellers. Buyers jibbed at the price—did not recognise the necessity for "new fangled ideas"—the old style was quite good enough for them. Gradually, however, as the market became educated to the new demands and requirements, and non-"Home Office" material was being condemned, the new designs began to make headway. Other firms modified or re-designed their fuses, patent agents grew busy, and the "renaissance" became a reality.

The evolution of the new fusegear is still incomplete, but already assumes definite form in a distinctive class of "safety first" fusegear, which, in general appearance, may be said to be as essentially English as was the perpendicular architecture of the Middle Ages.

No one had recognised this change more than the German manufacturer. For years he had grown accustomed to pouring motors, switchgear, and accessories into this country in a steady stream. With one or two marked exceptions, the German fuse failed to comply with our Home Office Regulations, and there were distinct signs, prior to the war, that the Germans were taking strenuous steps to attack the British home trade in ironclad switchgear built to our Home Office Regulations. A great amount of time and paper is being wasted in discussion over the inevitable German competition after the war. The wisest plan, from the manufacturing point of view, is to get to business, and, by thorough organisation and careful design, to produce an article unequalled in efficiency and price. The rest may well be left to the politicians.

The home market has always preferred an easily rewirable fuse. While the cartridge fuse has its many supporters, it cannot by any means be said to be so popular as abroad. For the present, at any rate, the easily rewirable fuse, encased in some form of tube and supported by an insulating shield and handle, would appear to be the main feature of the removable "Home Office" unit of to-day; while the base unit includes some suitable protection for the metal contacts, bus-bars, &c., the whole combination making a shock-proof fuse. There are, however, many features requiring recognition and development, before we can hope to regard the question of our "Home Office" fuses with any satisfaction or credit to ourselves. Only too frequently the design of low-tension switchgear is left in the hands of junior draughtsmen, who produce interesting assemblies of detail parts, but with little regard to the functions to be performed.

Shielding of Live Parts.—The shielding of live parts is a matter provoking considerable discussion, particularly when the base contacts are in question. All are agreed upon the necessity of well shielding the hand from any danger from the handle contacts or fuse wire, and suitably shielded grips are universally provided. Opinions may differ as to the efficacy of some of the designs marketed, but the safer types of handle must ultimately prevail.

When the question of shielding the base fittings comes into consideration, we do not find the same harmony. When the switchgear is in some special position, and only accessible to duly authorised persons (*e.g.*, in "rooms, compartments set apart for the purpose"), it would appear that contact shielding may not be insisted upon, but the average board about a works, enclosed in a wood or iron case, should unquestionably be effectively guarded in every way against accidental shock.

To comply fully with the Regulations, one has to consider the fuse under all conditions. Thus, it is possible to combine the base contact shield with the handle, so that insulating shrouds carried from the handle effectively cover all live parts. If, however, the fuse handle is withdrawn, the protection to the base contacts is likewise removed, leaving the board entirely unprotected. The fact that the shields are on the handle tends to make the operator careless, and he is inclined to ignore the danger in the contacts and bus-bars. There is, further, the danger of making accidental contact with the exposed contacts when handling an adjacent fuse.

The bus-bars also require protection. Some firms fit these bars behind the fuse bases to protect them, others fit them at the front and shield separately, while still others carry them in suitable holes passing through the bases. Whatever arrangement is adopted, the danger of accidental contact should be considered, and all live metal effectively shielded as much as possible.

Other designs of fuses are rendered unsafe by reason of the fuse wire terminals on the handle being exposed, even though the base contacts may be fully protected. This not only offers a possibility of accidental shock, but by the very fact of the covered contacts and shield-handle lulling the operator into a false sense of security, offers additional danger. The risk is, of course, greater in the case of the smaller sizes of fuses with merely a finger-grip. The unused fingers curl themselves into unexpected positions, and find the live spot, if it is to be found. The solution, therefore, appears to consist in so arranging the fuse wiring terminals that no live parts can be accidentally touched by any normal individual. The fool looking for trouble with a steel rule or wire, and poking his finger down openings to see what

he can find, must always expect a suitable reward for his folly.

Hot Handles.—With long-break fuses there is frequently difficulty in handling the fuse handles, owing to the excessive heat of the grip. It is hardly realised that each fuse wire is a small electric heater on its own, and, in a confined space, may heat up the handle to a dangerous degree, softening clips and burning the hands. When a man burns the skin off the palm of his hand in pulling out a fuse, or has to use cotton waste to get a safe grip, it is time that fuse was re-designed. Yet a large percentage of the present-day fuse is of that brand. If the designer had to re-wire and handle his own fuses, he would pay more attention to their cool working. It is undoubtedly necessary, therefore, in design, that the question of hot fuses that cannot be safely handled, should have equal consideration with the effective shielding of live parts.

This matter is intimately bound up with the questions of break, and ventilation of the fuse wire, both of which are dealt with at a later stage. If any doubt exists on the matter, it is always wiser to have a new design modelled by hand, for the purpose of testing the heat by actual experiment, before any expense is entailed in the manufacture of tools, &c. The Potteries are always willing under ordinary conditions, to assist manufacturers in these matters.

Fuse Break.—Passing to general questions of design. It is to be hoped that some day the Engineering Standards Committee will be able to turn their attention to the standardisation of fuse-breaks. Under the varying specifications, corporation regulations, and manufacturers' designs of to-day, we have a multiplicity of breaks for the same conditions.

Fig. 2, gives a graph showing 500-volt fuse-breaks by several of the leading British manufacturers. It will be

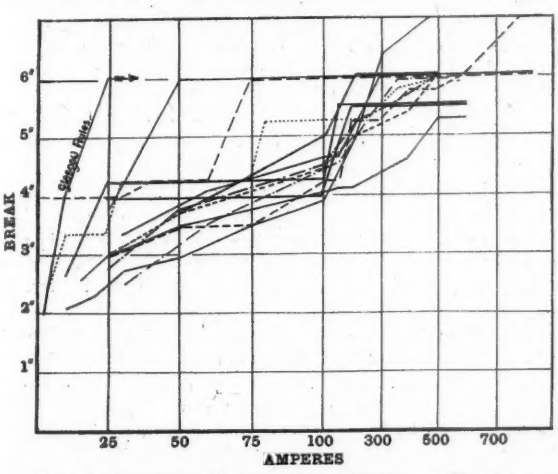

Fig. 2.—Showing 500-volt Fuse Breaks by Various Manufacturers.

seen that there is a considerable variation in the lower capacity fuses, and the various makes only draw into reasonable harmony towards a 6-in. break for 500 amperes. Soaring well above the majority is plotted the Glasgow Corporation fuse-breaks.

It seems hard to realise that all these varying sizes are seriously put forward by manufacturers to perform exactly the same function. Surely it should be possible to establish some suitable standard, leaving each manufacturer to work out his own details. The circuit opening efficiency could, and should, be covered by a definite clause as to the conditions under which each size of fuse should effectively blow.

One has seen a long-break fuse deposit its fragments about the room when blown on a short test, while specially designed shorter break fuses have repeatedly snapped out the arc without the least damage to themselves. Without wishing to minimise the question of break, it has admittedly grown into a fetish with many firms, and is often used as a safety-valve for badly-designed gear.

While on this question of tests, one might with advantage give extracts bearing upon the matter of testing fuses from the rules of the American National Board of Fire Underwriters:—

(67*c*). Cut-outs must operate successfully on short circuits under the most severe conditions with which they are liable to meet in practice, at 25 per cent. above their rated voltage, and for link fuse cut-outs with fuses rated at 50 per cent. above the current for which the cut-out is designed, and for enclosed fuse cut-outs with the largest fuses for which the cut-out is designed.

With link fuse cut-outs there is always the possibility of a larger fuse being put into the cut-out than it was designed for. . . . Again, the voltage in most plants can, under some conditions, rise considerably above the normal. The need of some margin as a factor of safety to prevent the cut-outs from being ruined in ordinary service is, therefore, evident.

The most severe service which can be required of a cut-out in practice, is to open a "dead short-circuit," with only one fuse blowing, and it is with these conditions that all tests should be made.

(68*k*). Enclosed fuses must not hold an arc, or throw out melted metal or sufficient flame to ignite easily inflammable material on, or near the cut-out when only one fuse is blown at a time on a short circuit on a system of the voltage for which the fuse is rated.

The normal capacity of the system must be in excess of the load on it just previous to the test, by at least five times the rated capacity of the fuse under test.

The resistance of the circuit up to the cut-out terminals must be such that the impressed voltage at the terminals will be decreased 1 per cent. when a current of 100 amperes is passed between them.

For convenience, a current of different value may be used, in which case the per cent. drop in voltage allowable would vary in direct proportion to the difference in current used.

The above requirement regarding the capacity of the testing circuit is to guard against making the test on a system of so small capacity that the conditions would be sufficiently favourable to allow really poor fuses to stand the test acceptably. On the other hand, it must be remembered that if the test is made on a system of very large capacity, and especially if there is but little resistance between the generators and fuse, the conditions may be more severe than are liable to be met with in practice outside of the large power stations, the result being that fuses entirely safe for general use may be rejected if such test is insisted upon.

One wonders how many of our British fuses would satisfactorily comply with these regulations and tests.

(*To be concluded.*)

THE NEGLECT OF COMMERCIAL MATTERS BY THE ENGINEER.

By JOHN MARKS.

The neglect of business matters by engineers in the past has had an effect on the engineering industry which is too often overlooked, especially when ways and means of setting the engineering industry more firmly on its feet are being discussed. Let us see what has been the effect on the industry as a whole, and on the electrical engineering industry in particular, of the want of business qualities in so many of our engineers.

Right from the start of the electrical industry the majority of engineers have been too much accustomed to look on the business side of the matter as beneath their notice, and this policy has had the following unfortunate effects.

The manner of financing many of the original electrical concerns was left in the hands of financial men who cared nothing for the industry, and less than nothing for either the great possibilities of the electrical industry or the benefit to the nation of its correct development. What they did care about was being able to float companies on to the general public at heavy promotion profits, afterwards taking the first opportunity to get rid of their own holdings in the various concerns.

The engineers who were financed by these people were as clever and able a set of men as any country ever possessed. In the majority of cases, however, they were purely engineers, and not business men in any way.

They conducted many and valuable experiments, but paid too little attention to getting goods delivered; often they developed personal fads, and ran these fads at the expense of the company long after other and rival concerns had produced more suitable and reliable, if somewhat less novel, designs. When profits were made, and in the early days they were made, in spite of the faulty financial management, they were too often divided up to the hilt, and little provision was made for the days when more firms would be in the field and competition would be much keener.

Assertion without facts to back it up is of little value. The writer, therefore, mentions one or two instances, with which he was quite familiar, of faulty management by clever, but non-businesslike, engineers.

One concern, some years ago, appointed a very clever and scientific engineer as its head. One of the first positions taken up by that engineer was to state that in connection with a new line then developing, he was going to make the

product turned out from that works the perfect product of its kind. A very worthy object, and one which might quite well have been attained along with commercial success if only businesslike methods had been employed.

Orders were fairly plentiful at the time, and the product of that firm was then as good as that turned out by any other firm, and the projected improvements could have been carried out on each fresh batch of machines put in hand; at any rate, that is what a businesslike manager would have done. This policy was not sufficient for the engineer in question, who actually stopped machines going out which had been tested and more than satisfied the specification under which they were ordered. No matter, they were not to go out; some detail improvement had occurred to the manager overnight, perhaps, and those machines must wait in the shops, be partially dismantled, the detail improvement fitted, and the result tested. It may seem incredible, but it is a fact that in some cases machines were tested and partially dismantled twice and three times before they went out.

Naturally, customers became first impatient, and then disgusted, and got into the habit of not expecting delivery from the firm, the natural consequence being that they placed their orders elsewhere. Unhappily, the firm had a good standard line of essential goods in the electrical world, and were, in fact, in possession of a really good paying speciality; for a time the money earned by this speciality enabled the process described above to go on without altogether upsetting the dividends.

This could not last for ever, and by the time the perfect apparatus was on the market the firm found that people had lost faith in its ability to deliver anywhere near to time; also, that other firms were then making and cutting into the market in the original special line in which the firm had done so well.

The engineer in question was disgusted to find that people would not pay an enhanced price for his apparatus, though it was undoubtedly the most efficient on the market. This extra efficiency, however, only amounted to about ½ per cent. or ¾ per cent., and the money spent in gaining it made the apparatus unnecessarily expensive.

Had the batches of apparatus for which customers were waiting been delivered, and the improvements incorporated in the next batch made, then the same perfection could have been reached, the firm's good name and connection retained, and money brought in which would have helped to pay dividends and support experimenting as well. In fact, under such circumstances there would have been many firms ready to pay rather a higher price for the superior article. The policy which was followed upset the whole financial state of the concern and cut down dividends to vanishing point for some time.

In another case the writer saw the same idea carried out, but with regard to a different product. When the writer happened to mention to one official that money was being needlessly expended the same answer came out, namely, that the older department could earn more than the newer department could spend. Here, again, financial wreck, or something very near akin to it, resulted.

Again, in another instance, an engineer-manager not only spent a tremendous amount of capital in trying to carry out a pet theory in connection with the governing of engines, but also carried his experimenting on to the premises of the firm's clients. This process gave annoyance to the firm's customers, who pointed out that they required their engines to drive their factories. The result was not an assurance that if the various experiments were a source of annoyance to the clients, the experimenting would be discontinued, but consisted of the information, conveyed in a chilling tone, that the plants belonged to the makers until the guarantee had run out, and that they (the makers) would do as they pleased. Naturally, clients fell off, the firm got into difficulties, some of the bolder spirits suggested to the engineer-manager that he should drop these costly and futile experiments, and the engineer in question promptly put in his notice and left the firm.

Now cases such as the above, which can be vouched for by many people, are by no means isolated cases; similar incidents must be known by any engineer who has spent, say, the last 20 years in the British engineering industry, and particularly in the British electrical engineering industry.

The result has been that in the British electrical industry one finds company after company which has had its capital reduced, and company after company which pays either nothing or a totally inadequate return. If every concern confining itself to the manufacture of electrical goods was in the same position, it could then be argued that there was something radically wrong with the state of the whole industry in this country. The above, however, is not the case; plenty of firms give a good return to their proprietors, and have done so for many years, though many of them started up after the first boom period had passed. In every instance, however, such firms have been sensibly managed on the business side. Their managers have always remembered that the purpose of the company was to make dividends, whether it made them on high-class dynamos or cheap rat-traps.

Now the effect on the whole industry of the financial neglect outlined in the above examples has been to cripple every electrical concern in the country. Those firms which have always paid a steady return on their capital could have either paid more in dividends, or put away money for development, or reserve funds, in larger amounts had the badly managed type of firm been paying. Those firms who are not paying simply have to get work at any price in order to keep going. Thus, profits are cut and competition becomes exceptionally keen for all firms concerned. Naturally, capital will not flow towards an industry which is not in a healthy financial state, and here, again, the badly managed firm makes it difficult for the well managed concern to extend its works.

Another and more regrettable effect of such mistaken policy has been to cultivate in the mind of the business man the idea that no engineer ever had, or could have, any financial sense, and that it was necessary to keep a sharp eye on his little proclivity for spending large amounts of money in somewhat unprofitable ways, especially when this meant the delaying of delivery and disappointing of a customer. Consequently, all the best appointments are held by the purely business man in by far the majority of cases, and the business man, with a far less expensive or trying professional training, usually runs the engineers who are responsible for the design of plant turned out by the works, or for the maintenance of the plant necessary to operate an electric railway.

The engineer, especially the thoroughly well-trained man of about 30 or 40 years of age, complains bitterly of the fact that he is remunerated at a far less rate, worked more hours, and carries far more responsibility than his financial colleagues; yet how often do good engineers spoil themselves when a chance of showing a little commercial ability comes along.

The writer gives two instances from personal knowledge, showing different attitudes of engineers towards the business side of engineering.

A relative, who was manager at a large engineering works, prided himself on his business abilities. Quite a short time ago an engineer with ideas on the manufacture of motor delivery wagons and swift tractors was introduced to him, with a view to getting the inventor's ideas carried out and tested. Let us consider how the matter was taken up.

The statement of the relative in question was as follows:—"I could see from the beginning that his idea would hardly be likely to be a success, and that he was somewhat vague in his ideas of business; so I proposed that before we carried out any work at all we should have a definite agreement regarding all work done for him, and the payment for the same." How typically British! No tact; no idea of chatting over the matter with the inventor, who did not want for money; no suggestion here and there in order to sound the trend of his ideas on the subject, and to see whether he would be open to accept advice or not; none of this sort of work, and then a tactful allusion to the matter of payment for work done and the proposal for a regular agreement. No; a demand straight out for cash down almost, which in itself showed lamentable want of tact in that it displayed want of faith in the idea and its inventor.

The work was done, the tractor made, experimented with, and tried on various gradients, but it did not come up to the inventor's hopes. It was, after some months' trial, abandoned, and my relative then bade the inventor a friendly good-bye and patted himself on the back in that the firm had received profitable payment in full for all they had done; and there he was content to let the matter end. Asked if the tractor could have been improved, the answer was, "Oh, yes; I believe it could; there was one point in the design of which the inventor was rather fond, and which I knew would trip him up."

Now let us take the American or German engineering manager's view. The trials show that the inventor's idea is not altogether feasible, and then the suggestion is tactfully made that, if the inventor will permit, the firm will be pleased to put money into the idea, as they consider that with a little alteration the tractors would be quite satisfactory. Experiments would have followed, the design been thoroughly developed, and another paying line added to the firm's enterprises. Please observe that the mistaken policy was adopted by an engineer who thought that he was an up-to-date business man.

As a contrast to the type of engineer dealt with above, the writer was pleased to meet and entertain, a short while ago, the manager of a large constructional firm; their business is not electrical work, but the lessons to be learnt from this engineer's policy are of value to any engineer, electrical or otherwise.

Naturally, talk drifted to prospects of business when peace shall be declared. The opinion was then expressed by the writer that first-class business and technical organisation would be more than ever necessary to obtain any success worth having.

The engineer in question stated that his own opinion was that in the days to come business would be most effectively obtained by what he was pleased to term first-class and intensive advertising, followed up by representatives possessing strong personalities. Amongst the greatest of their assets he rated tactful handling of possible customers, and also called for a thorough understanding of the technical points of the work in question. He stated that he had difficulty in getting good engineers who were tactful representatives, or good representatives who were acquainted with their products from A to Z. The writer happened to draw his attention to the disparity usually existing between, say, the managing engineer's salary and position and that of the general manager of a business, pointing out that the latter was generally much

better remunerated, and had had a much inferior education and training to that of the engineer.

The engineer in question admitted the disparity in emoluments, but insisted that it was no more than fair, his statement being that the man who managed the concern in such a manner that it earned a good dividend was not only providing the possibility of a good and also improving position to those on the staff, but, by tending to bring further capital into the industry, was benefiting the whole community. He stated that at an early point in his career he had resolved to get the controlling position of some business before he reached 35 years of age; that he went into the shops during his practical training with the idea of one day selling the goods; that when he got into the drawing office he meant having the position of leading draughtsman as soon as it was available. Having, after a few years' hard work, attained that position, he realised that, much as he liked the engineering side of the business, something more was required of a man who aimed at holding the reins. With that end in view, he took every opportunity of influencing business for his firm, and when sent out to try and talk over possible clients on subjects of a technical nature, used the utmost tact of which he was capable. The result was that he attained the position of deputy-manager, and finally of general manager.

"Now then," he observed, "I am a much better man than the technical man alone; I not only help to arrange the designs, but annually get thousands of pounds' worth of work for the firm and all connected with it. Take my leading draughtsman, a splendid fellow, a first-class man whom I should be sorry to lose. I can't promote him to be an outside representative or my deputy; if ever he goes out to see about a contract, or any proposed work, there is always a dickens of a row to follow, and a possible loss of a customer. When possible clients make statements which are wrong fundamentally, he contradicts them and tells them that they do not know what they require; the proposed client gets in a huff, snaps back, and my leading draughtsman then shows the client in plain unvarnished terms that he does not know anything about the matter at all, and is a very poor sort of person when considered alongside an engineer. When spoken to about making such a hash of things, and counselled to be tactful, he retorts that he cannot, and will not, be told what is correct by a non-technical man. On the other hand, when I get that type of customer I handle him gently, find out his pet idea, and then gradually work him round by letting him think that I agree with him, until he comes somewhere near to a correct view of the case. This may take me an hour or more, but sooner or later I convince him by quiet, reasonable, and friendly conversation that the only way in which to carry out the work is the way our firm does it." The above policy may seem obvious, but how often is it carried out by engineers in a managing position? Too often the tendency to become dictatorial, and even testy, with a customer is considered to be quite a correct attitude.

The directing of a great business is like unto the conducting of a great orchestra; the engineer in an engineering concern is certainly the most important instrument; but as the purpose of an orchestra is to interpret some great musical work in a perfectly harmonious fashion, so is the purpose of an engineering business to earn a return on its capital. In the one case, neither the leading violin nor the 'cello player is permitted to display his own talents in such a manner as might endanger the production of the masterpiece; nor can the engineer be permitted to indulge his own fads if it means interference with dividend production. Both men must obey the man who organises the whole process in such a manner that the desired effect is produced with harmony.

In both cases there must be a conductor who will balance the efforts of each separate player or department; and in both cases the talent required for this conductor is not proficiency of an extraordinary degree in any one line, but capacity to organise other people's work, in order that a desired result may be attained. If the engineer is to rule in an engineering concern, then he must be something besides an expert engineer; he must be able so to conduct the firm that the desired end, dividends, is attained, or make room for someone else, who may not be an engineer, but who is a successful organiser and director of other people's efforts.

Let us keep an eye on our competitors, especially those from enemy countries; but let us not forget the severe handicaps which our own mistakes of the past have imposed on us. By so doing we shall be in a stronger position than ever to meet both our competitors and our shareholders.

THE INSTITUTION OF ELECTRICAL ENGINEERS AND ALIEN ENEMY MEMBERS.

As briefly stated in our last issue, the special meeting of corporate members to consider a resolution altering the Articles of Association was duly held on Wednesday last week. Owing to the difficulties which arose in the course of the discussion, the resolution was not put to the vote, and it was decided to call a fresh meeting to consider the whole question untrammeled by the restrictions which, as explained below by "W.B.E.," necessarily tied the hands of the meeting. No time was lost by the Council, the meeting being called for Wednesday this week; the result will be found in our "Notes" columns to-day.

The following is a brief account of the proceedings at the first meeting:—

The President, Mr. C. P. Sparks, explaining the object of the meeting, said that for some time after the Council had stated in the *Journal* what powers it possessed to deal with alien enemy members, no action was taken on the part of the members to put Article 41 in operation. Eventually, however, a petition was received, signed by 17 members, and the Council, after consultation with a deputation, had called that meeting in accordance with the Articles of Association to deal with the resolution [printed in our issue of February 18th, p. 206] modifying Article 41, and providing that any member who during war should be a subject of an enemy country should cease to be a member of the Institution. Moving the resolution, the President called upon Mr. C. Alfred Baker, who, in seconding it, read a letter which he had addressed to the Electrical Review [December 31st, p. 843]; correspondence followed, and he found no difficulty in obtaining 17 signatures to a petition—he could have obtained 170 if necessary. At a conference with the President the form of resolution was agreed upon, on the lines of a similar resolution adopted by the Iron and Steel Institute, and the meeting followed. The petition did not touch the question of naturalised aliens at all; they could not deal with any of these unless they dealt with all—and some of them had sons fighting for us. The resolution, however, covered the case of aliens who had not denaturalised themselves in their own country, who should be excluded.

Mr. A. Gay referred to a letter which he had written to the President with regard to the procedure to be followed, and to amendments which he had forwarded, and the President replied that he was advised by the honorary solicitor that the amendments were not in order, whereupon Mr. Gay strongly protested, and urged that according to the recognised rules of debate a relevant amendment must be in order.

Mr. C. C. Atchison thought the meeting would be farcical if limited to the resolution, and questioned whether a meeting held in London could be representative of the whole country; he held that every member should have an opportunity of voting. He considered that it should not be necessary for the members to act in such a matter—it was the duty of the Council to ascertain the feeling of the members and to take action accordingly. The resolution, in his opinion, did not go far enough, as it would not prevent alien enemies from rejoining after the war.

Mr. Gay moved the adjournment of the meeting and the holding of a postal ballot on the resolution and amendment, but the President refused to accept the motion, upon which Mr. Gay protested that the whole of the proceedings were irregular.

Mr. F. C. Raphael suggested that the resolution should be passed unanimously, and that afterwards the proposed amendments should be considered.

The President pointed out that any proposed change in the Articles must first be submitted to the Board of Trade for approval.

Mr. W. B. Woodhouse said he would support the resolution on the understanding that aliens who had not troubled to denaturalise themselves would be expelled, and Mr. E. M. Duncan, whilst suggesting that each case of alien membership should be dealt with individually, thought they ought to wait for the Institutions of Civil and Mechanical Engineers to lead the way.

The President refused to be guided by any other body, and pointed out, with regard to the question of naturalisation, that British law prevailed over German law in this country, so that naturalised aliens would not be touched by the resolution; but it would still be possible, under Article 41, for 10 members to take action with regard to any individual case. As for re-election after the war, that would be in the hands of the members themselves.

Mr. A. A. Campbell Swinton feared that the interpretation of the law with regard to aliens naturalised, but not also denaturalised, altered the conditions very much, and several members who were in favour of the exclusion of alien enemy members, including Mr. G. W. Partridge and Mr. J. H. Rider, declared their intention of voting against the resolution if it would not have the effect of excluding this class.

Suggestions to modify the wording of the resolution, and to adjourn the meeting, having been rejected by the President, Mr. L. L. Robinson proposed that the resolution be referred back to the Council and brought forward again in a form that could be amended so that it would be a resolution of the Institution and not of the Council. It was pointed out that the resolution ought not to be negatived, as this would produce an erroneous impression outside the Institution, and eventually the President, remarking that the matter was of very great importance, announced that the resolution would not be put to the vote; a new meeting would be called at which the various proposals could be fully discussed, and the final decision would be submitted to the Board of Trade for approval.

The meeting at the Institution of Electrical Engineers on the 1st inst. was extremely interesting, as revealing amongst other things the misconceptions which exist amongst professional —often business—engineers regarding business methods.

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After the resolution with which we are all familiar was proposed and seconded, Mr. Gay charged in with the question as to whether the proceedings were to be conducted according to the recognised rules of debate. The obvious answer would have been: "This is not a debate, but a meeting of a public company convened for a specific purpose, viz., to pass, if thought fit, a resolution altering its Articles of Association. You are at liberty to discuss the resolution on its merits; if you are in favour of it pass it, if you are not in favour reject it, but there, so far as this meeting is concerned, the matter ends." Why this answer was not given clearly and directly I am at a loss to know; it would have saved much in talk, though, of course, we should have lost much in entertainment.

Mr. Gay wanted to propose amendments, and mentioned the Mayor of Islington as authority that his proposals were in order. This did not necessarily prove that the Chairman's ruling was wrong; it might only prove that the Mayor of Islington knew no more of company procedure than Mr. Gay! As a matter of fact, his confusion is easily understood. If the occasion had been a meeting of the Institution *as an institution*, the members would have been at liberty to put forward any amendments they pleased, but it was a meeting of the Institution *as a company*, consequently the proceedings had to be conducted in strict conformity with the Articles of Association. There was no use in badgering the President. He didn't make the laws governing public companies, and he didn't make the Institution Articles; in short, he had in this particular case no option.

In submitting the resolution, the Council had undertaken a thankless job, and the meeting showed little appreciation of their efforts. But, really, they had some justification for their action. Seventeen members, as I understand it, brought the question of expulsion of enemy aliens before the Council. Meetings and negotiations took place. A proposal as to how to deal with the question was drafted by the group of members. The Council could not agree with that altogether, but intimated that with some alteration they could give it their whole-hearted support, and that a definite proposal could consequently come before a meeting with all the weight of the Council behind it. All right so far, but, alas! for the next stage. Instead of bringing this proposal or some resolution embodying it before the Institution, to be talked thin "according to the recognised rules of debate," assuming that there would be no opposition, they determined to alter the Articles of Association right away, and called a company meeting for the purpose. Their assumption was false. The subject is highly contentious, and a general debate at another meeting is to take place, after which the mangled remains of the various resolutions and amendments proposed may serve to indicate the lines on which a resolution can be drawn amending the Articles. In not submitting a resolution to the Institution first the Council were guilty of an error of judgment; that is all. But what were the Council thinking about to have made such a mistake?

The resolution seemed as clear in its meaning as language could make it. I very carefully considered the wording when the notice of the meeting reached me, and decided to vote for it. It appeared quite free from ambiguity, and my view was evidently that of Messrs. Baker, Swinton, Rider, Atkinson, and many others present. It was clearly stated that enemy subjects should cease to be members of the Institution, and with this I was well content. But, unfortunately, the President told us that the interpretation of the resolution was a question of law, with which statement I entirely disagree. As the wording stood, it was not a question of law at all, but a question of fact, and the fact is that until an enemy Government has released its subject from his obligations to his country of origin, he continues to be an enemy subject, and this whether we take him to our hearts by naturalisation or not. The latter event makes no difference at all, because it is not recognised by the enemy Government. It is true that, in the absence of release from his continuing obligations, the return of an enemy subject to his own country might imply his being imprisoned or shot, which would possibly bend his sympathies in the direction of the country of his adoption; but, nevertheless, he is still an enemy subject, and consequently, by the wording of the resolution, he is got rid of. Do the Council mean this, or do they not? If they do, let them say so clearly and put forward a resolution worded so that there can be no hedging behind legal argument. If they do not, they unconsciously deceived the men who went to the meeting to vote for the resolution, and in this case also a new wording will be necessary. Evidently, so far as our present Council are concerned, clarity of thought does not march with technical attainment.—W. B. E.

Wages at Greenwich Generating Station.—The L.C.C. Highways Committee has received a petition from certain employés at the Greenwich generating station for an increase of wages, and also an application for increased pay for overtime. The Committee reports that the question of the wages of these employés was settled by arbitration in June, 1915, and it is of opinion that they are not entitled to have their wages reconsidered by the Conciliation Board until June, 1916. As regards the application for increased pay for overtime, the Committee recommends that it be referred to the Electrical Conciliation Board.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

15,000-KW. Generator for Manchester Corporation.

In the "Contracts Closed" column in your last issue, a reference is made to the transfer of the order for the above machine from us to the British Westinghouse Co., and as the bald statement of this fact in times such as these might be misunderstood by your readers, we should be much obliged if you would allow us to point out that the change in the contract—which has been made by friendly arrangement between the parties—is simply due to submarine risks in sea transit, it being imperative in the national interests that this plant shall be ready for running by March, 1917.

Mr. Pearce has authorised us to state that this action is not in any way due to technical or political reasons, but has been determined solely having regard to the serious risks attendant upon the delivery of goods by water during the period of hostilities.

Brown, Boveri & Co., Ltd.
A. C. Eborall, *Managing Director.*

London, S.W., *March 3rd*, 1916.

City Guilds' Subject: "Electric Wiremen's Work."

I have read with interest the letter under the above heading from Messrs. A. P. Lundberg & Sons. The most important feature missing from the letter is the fact that the classes do not attract the men engaged in this section of the electrical industry. The bulk of the students with whom I have come into contact are invariably engaged in occupations outside the scope of electric wiremen's work.

There are indications of considerable modification in the subject matter of the syllabus, which, it is hoped, will bring the tuition in the classes into line with the requirements of so-called "wiremen," and thereby encourage larger classes and more candidates in the examinations.

In addition, electrical contractors should interest their employés in technical training and the advantages appertaining thereto.

W. Ellerd-Styles.

London, W., *February 29th*, 1916.

What is an "Electrical Contractor?"

Your correspondent "Contractor," on page 251, complains of consulting engineers who, while doing their best for their clients, do not assist "electrical contractors," which, in this particular case, seems to mean "wiring contractors"; but what right have such contractors to supply engines, dynamos, and plant they do not understand?

Is "Contractor" himself an engineer or electrician? If so, then he is an exception, and he should advertise his qualifications so that consultants may avail themselves of his assistance. Any man may dub himself "electrical contractor," though knowing nothing of electrical work, and not making any of the apparatus he uses; even the wiremen he hires have been trained by others; and he feels aggrieved if he does not get a middleman's commission on everything!

I have had 35 years' experience in this particular line of work, so I know what I am talking about.

Facts.

Cause of Flicker.

Mr. Bulsara's trouble with light flickering seems to me to be due to a broken earth return somewhere or other. The fact of the trouble being present with any of the generators running proves to me that the fault is either close to the switchboard or beyond it in the lighting circuit wiring. The vibration of the engines running is disturbing this broken earth wire more or less, according to the proximity of the engine to the fault.

I rectified a similar fault a short while ago in a lighting circuit on a 3-wire D.C. system, 230-460 volts. The fault had been on for two years, and was only noticed when the main middle-wire fuse blew. From this time onwards an occasional nasty flicker was observed in a certain circuit; the switches acted all right, but the withdrawal of the fuse did not affect the circuit at all. I knew then that I was getting light through the earth return of the conduit, which was being vibrated at times by the engine working close by and sometimes breaking the circuit.

Eventually, I opened out the faulty circuit and found the return wire trapped in the angle of a split elbow, and making a lovely contact thereto. If Mr. Bulsara's trouble is something like this he will find some fault on the earth return or middle-wire cable.

It cannot be on the outers, which are both above earth potential by 230 volts or more in his case, and would certainly blow the fuses. I should advise Mr. Bulsara, if the fault is only on a certain section of lighting, to have the return cables tested for an earth leakage.

If the fault is on every light in the place, then the main middle-wire cable is faulty at some point or other beyond the switchboard bus-bar connection, and should be tested out for earth leakage. If the fault were traced to valve trouble in each engine it would constitute a record fault, I think.

I should be glad to know the ultimate death of this fault, and hope Mr. Bulsara will acquaint the Electrical Review when he finds it.

Hy. Fowler,

Liverpool, *March 2nd*, 1916. *Electrician.*

Concerning Discounts.

In the interesting communication on the above subject your correspondent says: "Just why makers do this kind of thing it is not easy to understand." But the reason is not far to seek. Invoice clerks, and, indeed, most people who have the making up or checking of invoices, know nothing of "decimals," which they regard as a mysterious arithmetical process, which only schoolmasters and scholars, who have devoted their lives to the subject, can possibly understand. The invoice clerk works with a book of discount tables, and as these are made up for discounts of 1¼, 2½, 5, 10, 15 per cent. and so on, the reason for the imposing array of discounts is obvious.

It is rather odd, however, that cable makers and other jugglers with discounts have not heard of the marvellous discovery made by some brilliant genius in the tube trade (or is it the file trade which has the honour?). The tube makers use a standard list for all classes of tube, and different discounts are quoted for steam, water, and gas tube, &c. The discounts are single figures like 57½ or 62½, and so on. But the discount tables do not give discounts like these, so what is the invoice clerk to do, poor thing? Well, after a little instruction and a lot of hard thinking, it dawns on him that 62½ per cent. discount, for example, is simply 50 per cent. of the list price, plus 10 per cent. of the list price, plus 2½ per cent. of the list price, or 12s. 6d. per £1. The arithmetical genius simply takes 62½ per cent. off list = list × (100−62½/100) = list × .375 or list × ⅜. Thus does the wily tube maker win the esteem of the scholar and the plain clerk alike, "two at a blow."

The tube maker's method has a decided advantage in this respect, that all discounts are calculated on the *list price*, which is generally a round sum in pounds or shillings, or pence with no fractional parts. Compare the following:—

Cable Maker's Method.				Tube Maker's Method.			
List £146, less 25, 15, and 10 p.c.				List £146, less 42½ p.c. *Using discount tables.*			
Less 25 p.c.	£36	10	0	20 p.c. on £146 =	£29	4	0
	109	10	0	20 p.c. on £146 =	29	4	0
Less 15 p.c.	16	8	6	2½ p.c. on £146 =	3	13	0
	93	1	6	Total discount	£62	1	0
Less 10 p.c.	9	6	2	£146 less £62 1s. net.	= £83 19s.		
Net	£83	15	4	Another way is to take off 8s. 6d. per £1.			

The slight difference in the results obtained is, of course, due to the fact that 25, 15, and 10 per cent. is equal to 42.625 per cent., or .125 more than 42½ per cent.

I think that this is a most opportune time to invite discount jugglers to mend their ways and "put away childish things," and I suggest that the Electrical Review should take this matter up vigorously and now. If we are to compete successfully with our enemies after the war is over, we must "lay aside every weight."

"A Station Engineer" deserves a hearty vote of thanks for bringing this question up; we have suffered too long under the yoke of the discount designer.

John W. Black.

Glasgow, *March 6th*, 1916.

An Engineer's "Wages."

May I draw your, and other people's, attention to the first advertisement in the current number of your paper under the heading of "Situations Wanted"? It seems to me that the rate of remuneration for technical men is poor enough already, and advertisements such as this do not tend to improve matters.

If any firm can get the services of a well-trained engineer for "low wages," why should they pay high, or even moderate, salaries? Is it lack of *esprit de corps* that is responsible, to a great extent, for advertisements of this kind?

There is one advantage of trade unionism which might be applied to engineers here illustrated.

Disgusted.

Ealing, *March 6th*, 1916.

The I.E.E. and Alien Enemies.

From the feeling expressed at last night's Institution meeting, I am sure that no mere form of words will satisfy the general mass of members which does not render the exclusion of the German *after* the war total and (as far as is humanly possible) permanent.

This point I endeavoured to make in the following letter to the Council, the publication of which should now be no breach of confidence.

W. P. Anderson.

The Council of the
Institution of Electrical Engineers, London.

I.E.E. and Alien Enemies.

Gentlemen,—I am in receipt of your post-card of the 15th inst. With regard to the matter contained in it, perhaps I may be permitted to express my own personal view, which I know to be shared by a large number of your members in the North. This view is that the resolution has been drafted on wrong lines, in that, although we are logically quite safe from the intrusion of Germans at our meetings throughout the duration of the war, we are not protected from their becoming members after peace is declared.

There is little doubt that German commercial men will make a superhuman effort immediately after the war to regain their footing in our social and industrial life, using the membership of our clubs and institutions as a lever to that end; and that they will be successful in this aim in the course of a few years is more than probable, our national characteristics being what they are.

May I suggest, therefore, that a new resolution be framed making it impossible for any member of this race to join the Institution after the war? I fully realise that no rule can be made to hold "in perpetuity," but he will be a bold man who in the next 50 years attempts to rescind such a resolution passed *now*. Surely, also, partial achievement is better than the making of no attempt.

I would make the resolution I propose apply to Germans whether naturalised or unnaturalised (if legally possible), the former, in my opinion, being much the more dangerous of the two.

As indicative of local feeling here, I would say:—

1. That the rules of the Engineers' Club, Manchester, have been so altered that no present alien enemy can, in future, enter the Club either as member or guest.

2. That the City Corporation has placed upon its standing orders a resolution prohibiting the purchase of German machinery out of the public funds.

There can be little doubt that these steps will be of a most *far-reaching character*.

I have purposely only confined myself to the German, and would make it clear that the proposal is put forward not because he is our enemy, but because he is, and must be made to remain for many years to come, a social outcast with whom one cannot treat as with an honourable foe.

While extremely unwilling to be a party to any policy which might be considered undignified, I would make a strong appeal to you, as members of the Council, to give the above matter your very earnest consideration.

Yours faithfully,
W. P. Anderson, *Member.*

Manchester, *February 21st*, 1916.

Decimal Coinage and the Metric System.

I have been following your articles on the metric system with great interest, and, although it may seem like flogging a dead horse, I should like to point out that the introduction of anything metric at home and in the Colonies would be enormously to the advantage of British trade and intercourse generally with Netherlands India.

When the war is over and Germans realise that they are no longer welcome guests in British countries, they will probably swarm to this country, so that everything possible should be done to enable British firms to compete with them.

In addition to the many examples you have given of the advantage of using the metric system, permit me to point out that when using the Vernier. Take an example with the very common form of sliding callipers engraved with inch and metre scales. On the former 7/16 in. is divided into 8 equal parts, so that each division is 7/128 in., on the latter 9 mm. is divided into 10 parts, so that each is 9/10 mm. I put the callipers on my ruler and, finding that the reading is something more than 28 mm., run my eye along the scale, and, finding alignment at the third Vernier division, write down 28.3 without the slightest mental effort or delay. When I look at the inch scale, however, I find 1 1/16 in. with alignment at the seventh Vernier division, so that I have to write down 1 1/16 in. plus 49/128. Need I say any more?

Only a few days ago a gentleman who represents a very important American firm, and travels all over Java, told me that he was convinced that British firms had lost their hold on the trade greatly through their representatives and travellers not being able to speak Dutch. Now I do not suppose that many young Britons will learn this language, but there are plenty of young men in Holland who would be only too glad to work for a time in British factories so as to perfect their knowledge of English and learn British methods of business. There should be no great difficulty in attracting such young men, and as many of them would afterwards naturally gravitate to Netherlands India, even if it were not worth while to send some of them out in the interests of the

firms for whom they had worked, they would be of great use in pushing British goods of all sorts.

The following experience of my own may interest you: The chief engineer of a sugar factory saw the catalogue of a British firm dealing in small tools on my table, and asked me to order some for him. He made a list of what he wanted with the prices, which, to save me trouble, he kindly added up, making a total of something like £2:236:172. The smile with which I greeted this was perhaps in rather bad taste, but it was nothing to what he said about our monetary system.

I have written the above in the hope of advancing, if ever so little, the introduction of the metric system in British countries, and leave it to you to make such use of it as you may think fit.

C. H. Pownall.

Banjoewangi, Java, *January 6th*, 1916.

Mr. Trotter's Recommendations for Feeder Pillars.

Mr. Trotter's recommendations for feeder pillars appear to be very difficult to carry out in many cases. It would meet his requirements if the carcass of the pillar was made of wrought-steel or cast-steel.

It is a well-known fact that cast-iron will fly into pieces if struck a severe blow, but either wrought or cast-steel would be free from this defect. Indeed, it seems likely that the Eastbourne accident would not have had serious results if the pillar there had been of cast-steel.

The opinions of other engineers on this question will be interesting.

Feeder Pillar.

WAR ITEMS.

Australia and Enemy Holdings.—Statutory Rules, 1916, No. 13, made January 29th, under the Australia War Precautions Act, require:—

All naturalised persons of enemy origin, unless exempted by the Attorney-General, and all enemy subjects, to transfer to Public Trustee, before April 16th next, shares held by them in companies incorporated in Australia.

Public Trustee to be appointed by Government and to have authority to hold shares for twelve months after end of war, or to sell them at the request of transferor or by direction of the Attorney-General.

Proceeds of sale of shares to be paid by Public Trustee to transferor, unless Attorney-General otherwise directs, dividends or shares transferred to Public Trustee or held by enemy subjects to be paid to Public Trustee, and dividends on shares of naturalised persons to be paid so if Attorney-General requires.

Applications from naturalised persons to be exempted from regulations require to be made in writing to Attorney-General, accompanied by statutory declaration giving full particulars of name and address of place and date of birth, parentage, and occupation of applicant, and setting out list of names of companies in which he holds shares, number and value estimated of shares, and ground upon which application based.

The Attorney-General has absolute discretion to deal with applications as he thinks fit.

As to calls on shares transferred, the regulations provide that the Public Trustee may, at request of transferor, and, if directed, by Attorney-General, shall pay calls out of funds supplied by transferor, or out of proceeds of sale of some of his shares.

After the date of regulations any enemy subject, and any naturalised person of enemy origin to whom exemption has been refused, who sells or otherwise disposes of his shares to any person other than the Public Trustee, and any person who buys shares from any enemy subject or any such naturalised person, shall be guilty of offence against the Act, and the sale or transfer shall be void.

Naturalised person of enemy origin means person who having been subject of country with which United Kingdom is now at war is naturalised British subject by virtue of certificate of naturalisation issued in any part of British Dominions to himself, father or mother, or, in case of married woman, to her husband, and includes the wife of any such naturalised person.

The regulations apply to London Register, Australian Companies, equally with Australian Register.

Exemptions.—The Swinton and Pendlebury Tribunal has granted total exemption to one of the attendants at the Swinton sub-station of the Lancs. E.P. Co. The attested man, it was stated, ought to be badged with the rest of the company's workers, but was under the military age when the badges were supplied. Attendants at generating stations were in a reserved trade. Mr. Purritt, for the company, said he himself was doing the work of about six people, and he had had to get five men back from the Army to their employment. If the employé now appealed for were taken he did not know how the electricity supply of the district could be continued.

Temporary exemption has been granted John Gibson Grimes, whose exemption was applied for by the Windermere Electricity Supply Co.

At the Woolwich Military Tribunal last week an electrical firm applied for exemption for a specialist in automatic telephony. It was stated that this was not a reserved occupation, but in order to obtain his present position this man had had to undergo the training of certain reserved occupations. Formerly the firm had ten of these automatic telephone specialists, but seven had already gone, and the remaining three were absolutely indispensable. The firm had established three automatic telephone exchanges, and if anything went wrong these were the only men who could put it right. The certificate was granted conditional upon his continuing in the same occupation.

Portishead Tribunal on Saturday exempted an electrician employed by the Clevedon, Portishead and District Electric Light Co., who was stated to be the only skilled employé left, and whose services were necessary for the running of the plant.

Trading with the Enemy: An Australian Action.—We read in the "Melbourne Age," for January 20th, that a High Court writ has been issued on behalf of the Welsbach Light Company of Australia, Ltd., of Melbourne and Sydney, directed against the Commonwealth of Australia and the Federal Attorney-General. The writ claims:—

(*a*) A declaration that the Trading with the Enemy Acts are *ultra vires* of the Commonwealth constitution, or, in the alternative, that section 2, sub-section 2 (b) of the first Act is *ultra vires* of the Commonwealth constitution.

(*b*) A declaration that the proclamation of his Excellency the Governor-General, dated July 7th, 1915, pursuant to the Act, is unlawful.

(*c*) A declaration that the notice dated September 18th, 1915, declaring the plaintiff company to be, in the opinion of the Attorney-General of the Commonwealth, managed or controlled, directly or indirectly, by or under the influence of, or carried on wholly or mainly for the benefit or on behalf of persons of enemy nationality, or resident or carrying on business in an enemy country, is unlawful, and is also contrary to fact.

(*d*) An injunction restraining the further publication of the said notice.

The case was expected to come on for hearing before the full bench of the High Court in Melbourne last month.

German Press Campaign in Spain.—We have received the following communication from Mr. R. M. Nosworthy, president of the British Chamber of Commerce for Spain, Barcelona:—In view of the powerful and unscrupulous press campaign which is being carried on in this country by German and pro-German interests, the British Chamber of Commerce for Spain is strongly of the opinion that a combined effort should be made at once to counteract it by an efficient means at our disposal, viz., by bringing pressure to bear on Spanish newspapers by the organisation of British advertisers. Such organisation is intended to serve two objects: (1) The advancement of British commerce in Spain. (2) The well-merited support of those newspapers and periodicals which have declined to sacrifice their sense of truth and justice to the pressure of the German Press Bureau. Great Britain has already a large export trade with this country, but it might be considerably increased by judicious press advertising, which phase of commercial activity is still in its infancy in this country. This Chamber is of the opinion that a well-organised advertising campaign on behalf of British productions would certainly meet with immediate success, and this must apply especially to the ever-increasing number of proprietary and household articles of daily use. A special committee of this Chamber has been formed to deal with the subject on the following lines:—

1. Advertisements should be inserted only in those newspapers and periodicals free from German influence.
2. A list of the most influential newspapers and periodicals in Madrid, Barcelona, Seville, Bilbao, and other centres in Spain, with their tariff for advertisements, will be compiled and sent to advertisers on application.
3. The British Chamber of Commerce for Spain, having the placing of a large number of advertisements, may be able to obtain specially advantageous rates, rebates, and discounts, the benefit of which will be given to advertisers or their agents.
4. This Chamber will, if desired, undertake the translation of advertisements into Spanish, and their publication, free of charge.
5. Firms which prefer to leave their advertising to local agents should instruct them to patronise only those newspapers recommended by the British Chamber of Commerce.

Applications should be addressed to the Secretary, Advertisement Committee, British Chamber of Commerce for Spain, Plaza Cataluña 9, Barcelona.

Congestion at Havre.—The Commercial Intelligence Branch of the Board of Trade is informed by the Foreign Office as follows:—The French Government desire it to be known that the port of Havre is much congested, and it is consequently desirable that British exporters of goods for Switzerland should send, in their own interests, as little as possible by this route for the present; meantime efforts are being made to relieve the congestion.

Nottingham Corporation Contracts.—The Nottingham Corporation has unanimously decided to support the Manchester decision that no public contract shall be entered into with any body of German or Austrian nationality.

Controlled Works.—The number of controlled establishments is now 3,052.

German Trade Preparations.—The French Minister of Commerce and Industry has just communicated to the French Chambers of Commerce the intimation that, according to information received from authentic sources and supplied to his department by the Minister of War, Germany and Austria-Hungary are engaged in laying down stocks in America of certain classes of merchandise of prime necessity under the conviction that after peace is declared there will be a great demand for them, and consequently an enhancement of prices. These stocks will be held until the end of the war owing to the present difficulty of shipment. Among the goods scheduled for these manipulations are:—Wool, lard, animal fat, copper, tin, raw rubber, tires, cottons, oil, vegetable grease, soap, and woven goods. The Minister adds that he deems it needful to signalise these preparations, so that French commerce and industry may take measures to guard against being forestalled in connection with the products mentioned. It is, of course, obvious that copper, tin, rubber, and oils and grease are products in which the electrical industry have an interest.

War Trade Department.—Mr. W. C. Bridgeman is acting as assistant director of the War Trade Department, and will continue to represent the department in the House of Commons.

LEGAL.

Morshead *v.* Quasi Arc Welding Co., Ltd.

A claim by Mr. L. R. Morshead, an engineer, against defendants, electrometallurgists, Caxton House, Westminster, came before Mr. Justice Darling and a special jury, in the King's Bench Division on March 2nd. The plaintiff claimed damages for alleged wrongful dismissal from his position as technical representative. Defendants, who are the owners of patents for a special method of electrically welding metals, pleaded justification on the ground that they were dissati-fied and, in reply to that, Mr. Morshead contended that such dissatisfaction was unreasonable.

The jury eventually returned a verdict for the defendants, and judgment was entered accordingly, with costs.

Counsel for the plaintiff asked for a stay of execution with a view to a possible appeal, but this was refused.

Electrical Engineer's Libel Suit.

In the King's Bench Division, on Tuesday, before Mr. Justice Ridley and a special jury, Capt. Herbert Wm. Lowe, of Cricklewood, sued Mr. C. J. Weld Blundell, of Lulworth Castle, Wareham, for an alleged libel. Defendant did not admit publishing the libel. The letter complained of was written on a privileged occasion, and was *bonâ fide* and without malice.

In opening the case, Mr Lewis Thomas, K.C., stated that plaintiff was now a captain in a Warwickshire Regiment, and had been for 18 months in the trenches. Plaintiff was an electrical engineer. In 1911 he was approached by a friend of defendant's to undertake the management of the Float Electric Co., Ltd., in which Mr. Blundell was the largest shareholder. The company was engaged in the manufacture of a patent safety electric lamp. According to the agreement defendant was to find sufficient capital to enable the business to be carried on. There was a difficulty owing to sufficient capital not being provided by the defendant. Plaintiff eventually resigned his appointment, and his resignation was accepted. He received his commission in November, 1914. In July, 1915, on returning home, plaintiff found that defendant had been making certain reflections on his character. After a new manager had been appointed to take over plaintiff's work, defendant wrote a letter to Mr. Stephens, his accountant. This communication referred to the new manager, and stated:—

> But my experience with workmen is that they all follow exactly the tricks and rogueries of their predecessors, and his predecessor, Lowe, an ingenious thief, with the help of the rest of the gang—managed by just the same manœuvres and pretexts to get £1,000 or £3,000, and—sheltered him completely and pretended that the money had been fairly used in trading transactions.

Plaintiff gave evidence in support of Counsel's statement.

Mr. Charles Comins, chartered accountant, 50, Cannon Street, E.C., was called to show that the balance-sheets and accounts of the company were accurate.

Mr. Mitchell Innes, K.C., for the defence, stated that there was no evidence of publication. The letter was addressed to Mr. Stephens, who had acted as defendant's accountant. He also contended that the letter was written on a privileged occasion. It was addressed to an accountant whom defendant had consulted for the purpose of guidance and information.

The Jury, having briefly deliberated, returned a verdict for plaintiff, assessing the damages at £1,000.

Judgment was entered accordingly, with costs. A stay of execution was granted with a view to an appeal.

Sweden.—It is announced from Stockholm that the Allmanna Svenska Elektriska Aktiebolag has acquired the majority of the shares of the Nya Forenade Elektriska Aktiebolag, of Ludvika

BUSINESS NOTES.

Consular Notes.—SIAM.—The American Vice-Consul at Bangkok reports a demand for electric motors, tramcar equipment, telephone and telegraph supplies, X-ray apparatus, electric fans, bells, batteries, and a variety of similar goods. Bangkok is at present the only city in Siam supplied with electric power for industrial purposes. It has two electric light and power plants—the Siam Electricity Co., Ltd., a private company, and the municipal light and power station, owned and operated by the Siamese Government. Particulars of these undertakings have appeared in our pages.

CHILE.—According to a report from the American Commercial Attaché at Santiago, two new electrical companies have been floated in Chile. The Compania Eléctrica Canpolican, Rengo, Chile, has been organised, with a capital of 800,000 paper pesos (about £27,000), to take over certain electrical machinery already installed, and to purchase the concession for lighting the towns of Rengo, San Fernandom Rancagua, Peumo, San Vicente, and eight others. La Campania de Luz Eléctrica de Constitucion has been floated with a capital of 60,000 Chilean paper pesos (about £2,000) for lighting and providing power to the town of Constitucion, located in the Province of Maule, on the coast. Constitucion has a population of about 6,500, and is a popular seaside resort.

COLOMBIA.—The Colombian Congress, according to information supplied by the American Consul at Barranquilla, has appropriated $5,000 for the purpose of establishing an electric light station at Puerto Colombia to supply that village and the railway and steamship pier with electric light. In consideration of this sum the authorities of Puerto Colombia will be required to supply lights free for 10 years to the coastguard, post office, and telegraph offices, and one searchlight of 2,000 C.P., or two of 1,000 C.P. for use by the coastguard in lighting the bay for police purposes. The surveys and plans are under way. American machinery and equipment are to be installed.

ECUADOR.—The American Consul-General at Guayaquil states that, notwithstanding the fact that several contracts for the construction of the Esmeraldas-Quito Railway have been entered into between the Government and different parties, none of which have ever been fulfilled, another project was recently laid before Congress, and accepted, providing for an electric railway between the two cities. To give an impetus to the work, another law was enacted instructing the Executive to proceed without delay with the construction of the line, provided experts approved of the proposition. The line is to be built under the direction of a commission, composed of the Minister for Public Works and four persons nominated by the municipal Councils of Quito, Ibarra Tulcom, and Esmeraldas. The funds required are to be obtained from certain taxes designed as a guaranty for a foreign loan which has been authorised.

GERMANY.—In a report from Breslau, the American Consul in that city refers to the establishment of a new Electro-Chemical Co. (Electro-Chemische Fabrik Fürst von Pless) at Kattowitz. The purpose of this undertaking is the building of a chloride factory in the neighbourhood of Emmanuelsegen, near Boerschachte, and the production and sale of chloride of potassium, as well as of other electro-chemical products.

NORWAY.—A serious situation as regards the electricity supply of Stavanger was indicated in a recent report from the American Consul in that city. A lack of autumn rain threatened to produce such a shortage of electricity that the city might be without light and its factories without power. The lake supplying the water-power for the city's electric works had sunk more than 18 ft. below normal. Radical measures were being taken to conserve the remainder of the potential electric power. About 40 per cent. of this power (3,550 KW.) is used for light and heat, and about 60 per cent. (5,000 KW.) for the fish, textile, wood-working, &c., factories. The extreme northerly situation necessitates artifical light for a good part of the day. The electric works are in the mountains, about 18 miles from Stavanger, near Lake Oltedal, which furnishes the water-power. A project has been under way for obtaining the main power from a river about 60 miles from the city, connecting the wires with Lake Oltedal, so that both sources may be used. The unprecedented shortage was expected to hasten the work on this project, but two years at least will be required for its completion.

SPAIN.—The American Consul at Seville reports that permission has now been given for the extension of the telephone lines in that city to 22 towns in its vicinity. Some of the towns are petitioning for immediate connections, while some are waiting until proper financial arrangements can be made. It is expected that the first line will be installed between Seville and Guillena, as this is one of the neighbouring towns that has a considerably daily commerce with Seville.

Fire.—Messrs. Nalder Bros. & Thompson, Ltd., state that the fire which broke out at their works at Kingsland Green, on Sunday morning last, was fortunately discovered in time, and the damage done, though somewhat inconvenient, has not shut down the works. We are sure that their friends will excuse such slight delays as have been caused by this misfortune.

Board of Trade Inquiry.—The Board of Trade Commercial Intelligence Branch has been asked by firms at home for names of manufacturers of porous pots for electric batteries, No. 2 (5,000 required), and pumps for high vacua, power-driven.

Trade with New Zealand.—Mr. W. G. Wickham, late H.M. Trade Commissioner for New Zealand, now H.M. Trade Commissioner for South Africa, has furnished the following particulars relative to imports of machinery into New Zealand in 1914 :—Of the total value of the imports of machinery into New Zealand in 1914, about one-half paid duty under the preferential tariff. The electrical machinery and cables imported are almost entirely for lighting, telegraph, and telephone purposes. Of the imports of internal combustion engines, more than half are for motor cycles and motor boats. A further deduction for agricultural and dairy machines, and domestic and office appliances, leaves an exceedingly small residue available for industrial purposes. The following table shows the total value of imports of machinery into New Zealand in 1914 under the new classification, imports from the United Kingdom being especially distinguished :—

Under the preferential tariff.	From United Kingdom.	From all countries.
Steam engines and boilers	£48,037	£54,234
Internal combustion engines	132,467	156,701
Electrical machinery and accessories ...	147,954	236,163
Mining machinery	21.388	28,475
Sundry	113,925	160,691
Total	£463,771	£636,264

From the items quoted "Under the general tariff," we select two items :—Electrical cables and insulating materials, £123,916, United Kingdom; £156 005, other countries. Engineers' and machine tools, £34.545, United Kingdom; £57,844, other countries.

In this section the totals are :—£268,189, United Kingdom; £598.015, other countries, making the grand totals, £731,960, United Kingdom; £1,234 279, other countries.

The statistical headings relating to electrical goods have in the year under review been amplified, and now yield information of some interest and value. In every line the United States was the chief competitor, with Germany following at a long distance. It is satisfactory to know that two-thirds of the generators, motors and transformers imported came from the United Kingdom, and more than half of the lamps and fittings. In the groups of machinery where competition is open, and no preferential duties apply, the United Kingdom made a poor show in 1914. Leaving out of account insulated electrical cables, only a bare one-third of the remainder was of British make. Telephones in the past provided an instance of goods being consistently supplied to the New Zealand market from foreign works when they might easily have been supplied from works in the United Kingdom. Of machine tools the United Kingdom supplied nearly two-thirds; the remainder was shared by the United States and Germany, the latter country being credited with 5 per cent. Of the considerable importation of insulated electrical cable and wire Germany supplied about 12 per cent. of the general trade. Importation in 1914 by the New Zealand Government included shipments of German origin valued at £7,500.

G.E.C. Electrical Plant for China.—Much has been written of late respecting the undoubted value of foreign markets to British engineering manufacturers. As an example of what is being done, we may refer to a few electrical contracts which have been secured in China recently by the General Electric Co., of China, Ltd., whose head office is in Shanghai, with a branch office in Hong Kong. This company looks after the interests in Southern China of the General Electric Co., Ltd., of Witton, &c. An important contract for the electrical lighting of the ancient city of Ningpo has recently been secured. A specially interesting point in connection with this contract is that the negotiations were very protracted, even by the Chinese standard, as they took nearly three years from start to finish. The existing plant is of German manufacture, and was partly secondhand when installed. The new plant will consist of a 120-kw. "Witton" steam-driven three-phase, high-pressure alternator, complete with main high-pressure switchboard, feeder panels, transformers, &c. The generating station is situated in the Chinese quarter of the city, and to transmit the electrical energy to the European quarter, under the new scheme a "submarine" cable is laid on the bed of the river. Previously, the Chinese had a very primitive high-pressure cable laid across a pontoon bridge, which was opened from time to time for sailing craft to get through. No proper system of breaking connection was provided—a rough-and-ready method of connection and disconnection only being used. Another recent contract is for the complete electrical plant for lighting the city of Yangchow. Electric light has not hitherto been used in Yanchow, but the first demand is for plant of 160-kw. capacity. As in the case of Ningpo a "Witton" high-pressure alternator direct coupled to a Belliss and Morcom steam engine fed with steam from Babcock & Wilcox water-tube boilers, is used. In the south of China a contract was obtained recently for four complete lighting sets for the city of Kweilin. In addition to the above, plant and switchgear have recently been supplied to the Fatshun Electric Co., the Nanking Electric Co., Funshun City, &c. Several further contracts are now being negotiated. Besides the foregoing, the General Electric Co., of China, Ltd., has just supplied a 125-kw. three-phase "Witton" alternator, 10 10-h.p., one 25-h.p., and several smaller "Witton" motors for a Chinese cotton and rice mill at Yungchow. We understand further that the sales of Osram drawn-wire lamps, as well as electrical supplies generally, are exceedingly brisk in China and the company looks forward to a long period of great prosperity.

Annual Dinner.—The second annual staff dinner in connection with the Efandem Co., Ltd., Fallings Park Works, Wolverhampton, took place on Friday night, Mr. Jesse Varley (director) presiding. Proposing the toast of "The Company," Mr. C. H. Stephenson said that during the year the works at Wolverhampton had been made the chief office of the company. Mr. Varley, in replying, said that in 1911 they started with a capital of £15,000; to-day they had approximately £100,000 employed in the business, and whereas their sales in 1911 were roughly £11,000, this year they had reached £15.000 per month, and like all new companies, they had had their difficulties and troubles, but owing to the loyalty and devotion of the staff they had overcome them all. This year they had done well. It would be within the knowledge of most of them that a new company—the Scott Electrical Co.—had been formed, and it was proposed to lay down works adjoining those of the Efandem Co. The Scott Co. had been registered with a capital of £100,000, and it was proposed to take over the electrical side of the Efandem Co.'s business, in order that the Efandem Co. might be enabled to increase their output in the portable electricity line. For the comfort of the staffs, it had been suggested that they should purchase a further plot of land in Park Lane for the erection of mess rooms and an institute for the benefit of the Efandem, Scott and British Ferro Plate Companies. This would mature in time. In the meantime they had to look to their business. It had been his privilege to attend a gathering of the leading manufacturers of portable electricity in the country. The Efandem Co. were the largest manufacturers of portable electricity in the world. At the present time they had little or no competition so far as outside companies were concerned, but they had to face it in the future, and they were endeavouring to influence the Board of Trade to grant them a protective tariff. Last week they had an interview with certain officials of the Board of Trade, and they were informed that if the Efandem Co. would prepare a scheme, it would be received favourably—sympathetically. They were preparing a scheme for submission to the Board with that object in view.

Mr. P. Smith proposed "Absent Colleagues with the Colours," and said there were 65 men from their workshops serving in the Army.

A pleasing entertainment, which was provided, included songs and monologues, concerted items by the Efandem Glee Party, and a display by T.E.C. Society of Artistes.

Liquidations.—The Adnil Electric Co.—The following are among the unsecured creditors in this case :—

Acme Electric Co.	£55	Horn, L.	£34
Aland & Co.	44	Higgs Bros.	16
Anglo Engineering Co. ..	45	Hunt & Co., R.	13
Armstrong, W.	36	Leach, S. G.	18
Atlas Carbon and Battery Co.	13	Le Carbone	17
Bergmann Elektricitäts Werke, Berlin	27,704	Michael Abrahams, Sons, & Co.	39
Bush & Co., W. J.	127	Neuberger, J., Munchen ..	19
British and Northern S.S. Co.	13	Palmer & Co., A.	81
Booth, H. C.	12	Prechatyck, F., Berlin ..	26
Century Electric Co., St. Louis, U.S.A.	416	Rosenberg, R., Berlin ..	112
Crypto Electrical Co.	103	Reid, Ferens & Co.	44
Crammond, H. E.	55	Reliance Electric Wire Co. ..	36
City of London Elec. Ltg. Co.	25	Swedish General Electric Co.	1,182
Deutsche Telephone Werke, G.m.b.H., Berlin ..	1,965	Smith & Earle	215
Eschenbach, —, Berlin ..	47	Sterling Electric Co.	87
Enfield Elec. Cable Mfg. Co.	13	Straker & Co., E.	14
Fuller Electrical Co.	49	U.S. Electric Tool Co., Cin.	88
Goslin & Sons, S. B.	60	Universal S. and F. Co. ..	19
		White-Jacoby & Co.	24
		Walker Bros.	11

Reader's Patents and Engineering Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. E. W. C. Whittaker, 3, Portland Street, Southampton, the liquidator, by April 12th.

Holzapfel Marine Gas Power Syndicate, Ltd.—A meeting is called for April 4th, at 57, Fenchurch Street, E.C., to hear an account of the winding up from the liquidator, Mr. N. W. Ward.

Good, Marriott & Co., electrical and mechanical engineers, 4, Chesterfield Street, Nottingham.—Messrs. B. V. Marriott and F. E. Good have dissolved partnership. Mr. Marriott will continue the business under the same style, and will attend to debts, &c.

Economisers, Ltd.—This company is winding up voluntarily with Mr. W. F. Johnson, 18, Theobald's Road, Bedford Row, London, as liquidator. A meeting of creditors is called for March 21st.

In the matter of J. Davis & Co. (Southampton), Ltd., electrical engineers, Hands *v.* The Company, a receiver and manager was appointed by Mr. Justice Neville, in the Chancery Division last Friday. This was an application in a debenture-holder's action made because Mr. Thos. Davis, the sole director, had died suddenly.

Trade Announcements. — The Electrical Supplies Co., London, hold large stocks of wood blocks for electrical purposes.

With reference to a notice published in our last issue, Mr. E. I. Hill has removed from 26, Stanton Road, to 2, The Broadway, Wimbledon. Telephone: No. 1239 Wimbledon.

Messrs. G. Noakes & Co., electrical engineers, of 32, London Street, Greenwich, S.E., announce that owing to enlistments they are relinquishing the business.

In addition to the vehicles illustrated in our last issue, we learn that Electromobiles (Leeds), Ltd., have acquired the sole British agency for the "Urban" electrical vehicles manufactured by the Kentucky Wagon Manufacturing Co., of Louisville, Kentucky, U.S.A.

Bankruptcy Proceedings.—W. D. Birkett, factor of electrical goods, Whitley Bay.—Receiving order made at Newcastle-on-Tyne, February 28th, on a creditor's petition. First meeting, March 16th; public examination, March 23rd—both at Newcastle-on-Tyne.

J. Taylor Peddie, mechanical engineer, Aldwych Site, Strand.—March 18th is the last day for the receipt of proofs for dividend by Mr. F. S. Salaman, 1 and 2, Bucklersbury, London, E.C.

Book Notices.—*Questions and Solutions in Telegraphy and Telephony.* Final Examinations. By H. P. Few. London: S. Rentell & Co. Price 1s. 6d. net.—This book covers the questions set by the City and Guilds Institute in the final examinations of Telegraphy and Telephony for the period 1906-15, and gives very full solutions to the last papers. The syllabuses of the Institute in these subjects, and the answers to the numerical problems set in previous years, are appended. The answers given appear to be all that could be desired, and a great deal more than could be hoped for, by any examiner.

"*Journal* of the Institution of Electrical Engineers." Vol. 54. No. 257. March 1st, 1916. The issue contains the Seventh Kelvin Lecture on "Lord Kelvin and Terrestrial Magnetism." By Dr. C. Chree, F.R.S.

"Employers and Workmen under the Munitions of War-Acts." By T. A. Fyfe. London: W. Hodge & Co. Price 2s. 6d. net.

"Science Abstracts," A and B. Vol. 19. No. 218. February 28th, 1916. London: E. & F. N. Spon. Price 1s. 6d. each net.

The Electrical Press, Ltd., will shortly publish "The Motor Transport Year Book and Directory, 1916," at 10s. 6d. net.

The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c., for 1916. Compiled and edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 15s. net.—This valuable reference-book now makes its appearance for the twenty-third time, and is, if anything, more welcome than ever. It has grown appreciably in bulk; the text-matter now occupies 1,866 pages, the directory matter has been re-arranged, and French, Spanish, and Russian translations of the terms used in the directory have been appended. The revision of the Year-Book has been carried out as fully as usual, and amongst the new features are contributions on railway signals, aerial ropeways, electric drills, magnetic chucks, hydroelectric plant, mechanical draught, electrical plant, &c. "Electrical Engineering" has been overhauled by Prof. C. A. Carus-Wilson, and "Steam Turbines" by Mr. H. L. Guy. If one were to contemplate the compilation, *ab initio*, of a reference-book which should cover practically all branches of engineering, and should be so useful as to be almost indispensable to every engineer, one would be appalled by the magnitude and complexity of the task. Let us be thankful, then, that the feat has already been accomplished, and that in "Kempe's Year-Book" we have an invaluable desk companion, an encyclopædia in miniature, and all in one handy volume.

Eight Months' Italian Trade.—The official figures of Italy's foreign trade for the first eight months of 1915 have just been published, and they show an aggregate total of 3,667,394,168 lire, and a shrinkage on the figures for the same period of 1914 of 168,111,814 lire. The shrinkage was chiefly on the imports, which on a total of 2,296,200,000 lire, showed a falling off of 194,700,000 lire; while the exports, to the value of 1,565,900,000 lire, marked an advance of 26,600,000 lire. The exports to, and imports from, various countries are shown in the following table:—

	Exports, 1915.	Difference on 1914.
Austria-Hungary ...	104,926,000	− 32,139,000
France	270,055,000	+ 128,532,000
Germany	184,195,000	− 38,549,000
Great Britain ...	223,884,000	+ 28,704,000
Switzerland ...	178,513,000	+ 20,268,000
Argentina	70,206,000	− 14,618,000
United States ...	173,285,000	− 1,664,000

	Imports, 1915.	Difference on 1914.
Austria-Hungary ...	33,636,000	− 145,072,000
France	90,407,000	− 83,382,000
Germany	149,602,000	− 186,051,000
Great Britain ...	285,205,000	− 83,382,000
Switzerland ...	41,671,000	− 8,894,000
Argentina	234,165,000	+ 207,041,000
United States ...	771,617,000	+ 459,961,000

These figures show that, while on the one hand there has been a falling off in the aggregate interchange of goods with Germany and Austria-Hungary, there has been an increase of Italian exports to France, Great Britain and Switzerland, and of imports from Argentina and the United States.—*L'Elettrotecnica.*

Catalogues and Lists.—The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, have issued a blue ground show-card of Royal Ediswan drawn-wire lamps. An outstretched hand brings the lamp more closely under the attention than the card alone could do.

Messrs. H. Tinsley & Co., Eldon Park Works, South Norwood, S.E.—12-page illustrated pamphlet giving full particulars and prices of Dr. C. V. Drysdale's distortionless sine-wave phase-shifting transformers.

Messrs. Jenson & Nicholson, Ltd., Goswell Works, Stratford, London, E.—Circular giving particulars of their British Standard insulating compositions. Mr. Arthur Hutchings, who has joined the firm, will attend to all matters in relation to the electrical insulating varnish department.

Italy.—The Società Partenopea per Industrie Metallurgiche ed Elettriche has been formed at Naples with the object, while the war lasts, of manufacturing arms, munitions and war material, but later of working in iron, aluminium, &c., and selling the products of the same. The capital of the company is 1,000,000 lire in 10,000 shares of 100 lire each.

For Sale.—Darlington Corporation electricity department has for disposal two 100-kw. d.c. 460/520-volt dynamos direct coupled to enclosed steam engines; Messrs. Wheatley Kirk, Price & Co. will include in the sale by auction of the Barton Flour Mills, Gloucester, on March 29th, a 150-kw. electric light installation, complete with engine, boilers, superheaters, economisers, &c. Particulars are given in our advertisement pages to-day.

Board of Trade Inquiries.—H.M. Trade Commissioner in Canada reports that a firm in Toronto wishes to obtain agencies of United Kingdom manufacturers of electrical heating, pumping, and power house specialities. H.M. Consul at Rome reports that a local importer wishes to get into touch with United Kingdom manufacturers of small electrical appliances. Names and addresses can be obtained from the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Football.—An interesting football match was contested on Saturday, March 4th, between the Ediswan Lamp Works, glass department, and Siemens Bros. Dynamo Works, Ltd., for the Siemens Silver Challenge Cup. The ground chosen was at the "Boundary," Ponder's End, kindly lent by Mr. Pass. After a very well contested game the honours went to the Ediswan team, who scored 3 goals to Siemens's 1. All the proceeds are to be utilised to provide comforts for the local lads fighting at the Front for their King and country.

LIGHTING AND POWER NOTES.

Accrington.—Plant Extension.—The Electricity Committee decided to obtain tenders and proceed with the work of installing a coal elevator and conveyor, which it is estimated will cost £700.

Barnstaple.—The T.C. has consented to the electrical engineer superintending the installation of the electric light at the Science and Art Schools.

Barrow.—Plant Extensions.—The Electricity Committee reported that although the formal sanction of the L.G.B. had not been received to the borrowing of the moneys for the extensions, the Board had agreed to the order for the rotary converter being placed.

Birmingham.—Price of Electricity.—The Electricity Committee states that the reduction of the rates for the supply of electricity in 1912 has been fully justified, as the growth of the output more than compensated for any loss in revenue, and the surplus each year had steadily increased; up to the end of the September quarter last year, it appeared that the revenue due to increased output would compensate for the advances in the cost of fuel and materials. Towards the end of November, however, the cost of materials, and especially fuel, rose rapidly, and as a result the returns for the nine months indicated that whilst the present year would show a surplus, unless an alteration were made in the charges the increased costs during the next financial year would not be met by the receipts. The Committee, therefore, recommends an increase of 15 per cent. on all charges for lighting and 20 per cent. on the charge for power, to take effect from the March reading of the meters. The H.T. supply is given under special agreements, which now contain a coal clause, advancing the price automatically. As opportunity arises, the agreements without the coal clause are being terminated, and new ones substituted. The Committee proposes to apply to the traction supply the terms of the coal clause in the H.T. agreements.

Blackburn.—Turbine Pumps.—The Waterworks Committee has requested an inquiry as to the early carrying out of the recommendation with respect to the erection of turbine pumps on the Bowland main.

Bo'ness.—The T.C. has received the report of the consulting engineer, Mr. J. M. Munro, of Edinburgh, on the conditions and prospects of the electricity undertaking, and the need for an immediate extension of plant. He approves of the scheme of the National Electric Construction Co. to install a new boiler of 10,000 lb. evaporative capacity, with mechanical stokers, superheater, &c. and a 500-kw. high-speed turbine unit with condensing plant, at a cost of £13,900, and on his recommendation the Council agreed to apply for sanction to the borrowing of £14,500. Mr. Munro pointed out that at present the inclusive capital outlay on the whole undertaking per kw. of running plant capacity is £73 10s.; after the extensions are completed the capital outlay per kw. of plant will be approximately £51. The number of kw. connected a year ago was 739, now they are 1,092. The maximum demand on February 9th, 1915, was 285 kw.; in the corresponding week of 1916, it was 400 kw; on December 20th, 1915, the demand reached 465 kw. Recently a further 215 kw. of possible load was connected, and Mr. Munro adds that the load cannot obviously be carried with the present 500-kw. plant with no spares.

Bredbury and Romiley.—The U.D.C. has consented to the granting of an order to the Stockport Corporation to supply electricity in its area. The draft order provides that whenever the Bredbury and Romiley Council can satisfy the Board of Trade that it is in a position to supply electricity in its own district, the present order can be revoked.

Brighton.—Revised Charges.—The T.C. has given notice of a revision of charges for electricity as from the March quarter meter readings, as follows:—First 1,000 units, 6½d. per unit; ½d. per unit reduction for each extra 1,000 units to 3,000, and 4d. per unit for all above 3,000 units. Flat rate outside the borough to be 6½d. per unit; by prepayment meters in the borough 5½d. per unit and outside, 6½d. per unit. Power 1½d. per unit, first 2,000 units, beyond 1¼d. per unit.

Burnley.—Price Increase.—The Electricity Committee has increased the charges for electricity for ordinary lighting from 3½d. to 3¾d. per unit; for heating and domestic purposes from 1¼d. to 1½d.; and for traction for 1·20d. to 1·25d. The old rates for power remain, except that the charge will be plus 10 per cent. instead 5 per cent.

New Plant.—With reference to the inauguration of new three-phase H.T. plant, which has been installed by the Corporation electricity department, this had become necessary owing to the growth of the demand in one section of the town. A sub-station was erected at Holmby Street, and two 300-KW. rotary converters with transformers, switchgear, &c., installed. This plant is fed at 6,600 volts, three-phase, from a 2 000-KW. Westinghouse turbine set at the generating station. The set runs at 3,000 R.P.M. on steam at 160 lb. pressure, and is equipped with a surface condenser and turbine-driven pumps. Two 600-KW. rotary converters are installed to link up the A.C. and D.C. plant.

Burton-on-Trent.—Loan Refused.—The L.G.B. has refused sanction to the borrowing of £3,500 for works in connection with the electricity undertaking. The Board further stated that it appeared that the cost of additional transformers and switchgear might be met out of revenue.

Colchester.—The Electricity Supply Committee reports that the total output of electricity for the month of January was 199,400 units, as compared with 186,084 for January, 1915. The number of consumers was 2,773, as compared with 2,686.

Continental.—Italy.—At a meeting of the Consiglio Municipale, of Rome, in October last year, a loan to the amount of 6,814,000 lire was sanctioned for public electric lighting improvements. Of this sum, 1,137,580 lire has already been spent in new installations and in the conversion of the previously existing oil and gas lighting to electricity, and a further 237,565 lire has been disbursed in the erection of two 1,500-C.P. lamps; 101 600-C.P. half-watt lamps; and 750 200-watt, 100-watt and 60-watt glow lamps in some of the principal streets of the city and suburbs. It is the intention of the electric light department to proceed with the further extension of the public electric lighting service, and a further sum of 410,000 lire is to be spent on the installation of 53 600-C.P. lamps and 2,047 glow lamps.

Dartford.—Price Increase.—The U.D.C. has decided to hold a special meeting to consider the Electricity Committee's report and recommendations. A deficit of £3,000 is estimated on the year's working of the undertaking, and the Committee, in view of the increase in cost of coal, recommends that the charges for lighting and power be increased by 20 per cent. from April 1st. The L.G.B. is to be asked to sanction the borrowing of £1,076 excess expenditure over the amount sanctioned for the extension of the electric light station and plant, and to cancel the unexpended sum of £75 in connection with the overhead cable.—*Dartford Chronicle.*

Derby.—The Electricity Committee reports that with the contracts for coal now being concluded, it is hoped to ensure the supply for the ensuing 12 months. While the lighting requirements have fallen off, the demand for power has increased during the nine months ended December 31st with a profit increase of £4,000; in the 10 per cent. advance charges realised £2,600 during the nine months.

Felixstowe.—Mr. R. P. Wilson, the Council's electrical engineer, reports that it is necessary to install a booster, &c., to increase the pressure in part of the district. The Council has decided, subject to obtaining the consent of the L.G.B. to a loan, to provide the money, estimated at £140, for the work.

Guatemala.—According to the *Journal of Electricity*, one result of the war is that Ocos will lose its electric light. About nine years ago, the Kosmos liner *Sesostris* was beached on the coast, and the chief engineer, left in charge, supplied the town with electricity from the ship's installation. Now the price of shipping has reached a point where it appears to be profitable to dig a canal and float the ship back to sea.

Hastings.—Owing to the restricted lighting, the Corporation Electric Lighting Committee estimates a deficiency of £6,225.

India.—Electric Heating.—The Simla municipality is encouraging the use of electric heaters by offering special rates, bringing the cost down to, approximately, that of coal fires, consequently heating by electricity has become very popular in the town this winter. The high cost and difficulty experienced in obtaining satisfactory radiators, &c., from England led to the municipal electrical engineer experimenting in this direction, with the result that radiators, water-boilers and several other types of heating apparatus have been constructed to suit individual requirements. The local made heaters are favoured to such an extent that the municipality cannot nearly keep the supply up to the demand. Several types have been standardised, and they are produced at a cost of half to one-third that of imported heaters. The elements used are manufactured in the country and the design has been patented by the inventor. The public has the option of either purchasing the heaters or of hiring them. A special tariff, which includes both the hire of the heater and current, has also been introduced. These appliances are stated to be the invention of Mr. F. L. Milne, of the Simla electricity department.—*Indian Engineering.*

With reference to our note on page 202 on the subject of Calcutta charges, which was based on the statement of an Indian contemporary, we understand that the statement that the Calcutta Electric Supply Corporation charges 8d. and 4d. respectively per unit for lighting and power is incorrect, as the company allows a discount of 25 per cent. off these prices to all consumers. Consequently, it would be more correct to state that the prices charged are 6d. and 3d. respectively per unit for lighting and power. Further, the company allows a gradual scale of additional rebates to large consumers, reducing the prices down, in some cases, as low as 3½d. per unit and 2d. per unit for lighting and power respectively. The supply to the Government is at the rates charged to ordinary consumers. The only advantage to the Government is that it is allowed to aggregate its consumption at the different Government establishments for the purpose of getting the maximum rebates. Large consumers for power purposes at factories are supplied with alternating current at a pressure of 6,600 volts, at very low prices.

Japan.—According to a report from Tokio, occasional interruptions in the operation of the high-tension transmission lines in Japan have been found to be due to the fact that reptiles climb the masts and enjoy a sun bath on the cross arms, and, in the course of their walks abroad, create short circuits.

Kendal.—The estimated net deficit on the electricity undertaking, for the 12 months ending March 31st next, amounts to £370.

Leeds.—The local Chamber of Trades is leading a vigorous protest against the suggested increase of prices for electricity supply by the Corporation. One ground of protest is that large advances of salary have recently been granted to officials.

London.—Mr. H. W. Bowden, referring to the use of coke breeze under the boilers at the South Metropolitan Electric Light and Power Co.'s station, mentioned at the company's meeting recently that the results obtained over a period of nearly 12 months showed a considerable saving, notwithstanding excessive repairs due to design and stressed conditions. Although, owing to the demands on the plant, the experiment had been abandoned, he saw no reason to prevent the exclusive burning of coke breeze (unassisted by coal) in a boiler house properly designed and ventilated. This was important when using forced draught with a sulphurous fuel. He further mentioned that the new H.T. transmission lines and 3,000-KW. sub-station at Crayford, about 10 miles from the power house, had been brought into use. During the year about 1½ million units were sent over the feeders; the maximum load was 6,250 KW., and the coal cost was ·37d. per unit. New turbo-generator and boiler plant was expected to be in commission during the month.

Battersea.—The Electricity Committee recommends that owing to the restricted lighting an allowance of £1,000 be made in the next financial year from the total amount which would have been charged for public street lighting at the current rates.

L.C.C.—The Finance Committee recommends the County Council to sanction the borrowing of £3,000 by the Hackney B.C. for mains and switchgear, and of £2,000 by the Poplar B.C. for its share in linking-up costs.

Marylebone.—The revenue statement of the B.C.'s electricity undertaking, for the December quarter, shows a total income of £69,991, an increase of £5,832 over December, 1914. The expenditure amounted to £31,636, an increase of £3,197, *i.e.*, 1·042d. per unit as against 1·012d. in 1914. The net result is a balance of £44,168 available for capital charges, an increase of nearly 11 per cent., as compared with December, 1914. The output sold for the respective December quarters of 1915 and 1914 was 4,982,454 and 4,614,801 units. The Electricity Committee has refused a request for increased wages by members of the Amalgamated Union of Enginemen, &c.

The Metropolitan Electric Supply Co., Ltd., is increasing the charges for electricity for lighting, heating and cooking by a further 10 per cent., from the end of the present quarter.

Hackney.—The engineer recommends the installation of an auxiliary battery for excitation purposes at the generating station, at an estimated cost of £465. Hitherto the alternators have been excited from the main battery, but recently owing to a short circuit on the D.C. bus-bars and the consequent drop of pressure on the battery terminals, the excitation of an alternator was reduced so that the converters were able to send a reverse rush of power into the alternator and operate the reverse current relays, leading to a temporary shut down.

St. Pancras.—The Electricity Committee has reported on two or three fires which occurred in a reserve coal store in December and January. The chief engineer held that the pouring of water on the coal by the fire brigade had cause spontaneous combustion, although the fire brigade authorities did not agree to this view. It is estimated that the loss to the undertaking in cartage, labour, and calorific value is about £1,300.

Manchester.—The Electricity Committee, owing to the great demands on its plant, has been compelled to refuse a supply to a proposed new works, whose requirements would have been "equal to the whole of the lighting in Manchester" (says the *Manchester Evening News*). Ald. Walker, in referring to the loss of these works to the city, pointed out the absurdity of the opposition of the Ratepayers' Association and others to the proposals of the Electricity Committee, through which he does not doubt that the city has suffered considerably.

Nuneaton.—Insurance, &c.—The T.C. has decided to obtain quotations for insuring the electricity works against damage by aircraft, for a total indemnity of £12,000. In respect of restricted lighting for nine months ending December, 1915, the Electricity Committee has allowed a rebate of £150.

Ripon.—E.L. Proposals.—The City Council has adopted the Electricity Committee's recommendation that inquiries be made of the Harrogate Corporation as to what price it would supply electricity in bulk, at the city boundary, and also on what terms the Thirsk authorities would give a supply.

Shaldon.—E.L. Scheme.—At a meeting on March 2nd an E.L. scheme for the district, to be carried out on co-operative lines, was submitted by Dr. Purves, of Exeter, and a motion in favour of the project was adopted. The company interested proposes to supply current at 3d. per week per 25-c.p. lamp, or 2½d. per unit, if consumers do their own wiring.

Sheffield.—Loan Sanctions.—The formal sanctions of the L.G.B. have been received to the borrowing of the following amounts for additional plant at Neepsend:—£3,100 for reservoir pipe work and circulating water discharge pipes, valves, and bends; £1,250 for cables for connections and auxiliary boards; £49,742 for new plant and foundations, switchgear, and accessories; £45,050 for three new boilers, sludge pump and pipe work, screens, motor pump and housing, boiler foundations, sub-station equipment and transformers; £12,500 for cooling towers and foundations, coal shoots.

Southampton.—Ash Plant.—The T.C. has adopted a scheme of the electrical engineer for removing the ashes, clinker, &c., at the works, by other means than the existing coal conveyor. The total cost of the work is put at £500, which will be defrayed out of revenue. This includes £300 for a lift, for which it is proposed to obtain tenders; the remainder of the work will be carried out by direct labour.

Southwold.—Price Increase.—It is announced that the Electricity Co. has increased the price of current (7d. per unit), by 20 per cent.

Wigan.—Mr. S. L. Pearce, the city electrical engineer of Manchester, has been appointed to report exhaustively upon the Corporation's electricity undertaking.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Tramways Committee has instructed the manager to try for six months a new type of ventilated motor for the cars.

Australia.—The Melbourne, Brunswick and Coburg Tramways Trust is entering into negotiations with the recently-formed Fitzroy, Northcote and Preston Tramways Trust for the construction and the running of the latter system. It is understood that there is a good opening for the economical running of the two systems under one management.—*Melbourne Age.*

Sydney City Railway.—The N.S.W. Minister of Works forecasts the successful working of the City Railway from the commencement of operation, which is assumed to be in 1920. The first year's working is estimated to give a net surplus of £125,000, and for 1926, the net surplus is estimated at £369,000. The total cost of the work, which is to be commenced this month, is estimated at £7,000,000 Two types of car are under consideration, with accommodation for 100 passengers seated and 166 standing, and 98 seated and 100 standing respectively.—*Sydney Telegraph.*

Blackpool.—Commencing on April 1st, soldiers are to be allowed to use the Corporation tramcars on payment of half-fares, this applying to all routes except the circular routes.

Bristol.—Tramways Purchase.—At the annual meeting of the Bristol Tramways and Carriage Co., on March 2nd, Sir George White referred at some length to the negotiations which have taken place with the Corporation in connection with the proposal of the latter to acquire the tramway undertaking. In this connection, the correspondence between the Corporation and company, from October, 1914, to January, 1916, was published in the *Western Daily Press* of March 3rd, which, in an editorial, points out that the economic situation has completely changed during the war, and that the new situation has been used by the directors in the interests of the shareholders. Two years ago the situation favoured the exercise by the Corporation of its option; it could have raised money at 3½ per cent.; it could not now raise any money in the open market, and the Tramway Co.'s offer to find the money at ½ per cent. above current Government rate, would mean that the city would have to pay 5¼ per cent., which, with the provision for sinking fund, gives the proposal quite a new complexion. Our contemporary sums up the matter by indicating what appear to be three courses open:—(*a*) The acceptance of the offer of the Tramways Co. to sell to the city the tramways system and the motor-omnibuses on the financial terms which the present situation would require; (*b*) the acceptance of certain concessions (not as valuable as the Option Committee hoped to secure) on the condition of waiving the option of purchase for 14 or 21 years; and (*c*) to let the whole matter stand over until 1922. It further hints that the choice, under the circumstances, may lie between (*b*) and (*c*).

Continental.—Italy.—La Società Tramvie Campidano-Poetto is the name of a new company which has been formed in Cagliari, with a capital of £52 000, to acquire and electrify the Campidano and Poetto steam tramways.

Spain.—A concession has been granted to the Sociedad Tranvia del Este de Madrid for the construction and working of an electric tramway in Madrid (Monte del Pardo district).—*Board of Trade Journal.*

Switzerland.—The *Electric Railway Journal*, quoting a Continental source of information, states that bow collectors are to be substituted for trolley collectors on all the Zurich tramway cars. A great reduction in delay, due to trolley wheels jumping off the wire, and repairs, has been found on a route experimentally equipped with bow collectors.

Darwen.—School Return Tickets.—The Tramways Committee has decided to issue return tickets for school children for one penny, available for the journeys to and from school.

Edinburgh.—Several important notices of motion referring to tramway affairs have been tabled by the T.C., including a proposal to consider the expediency of appointing a tramway manager and establishing a tramway department, the advisability of appointing a tramway engineer to attend to the interests of the Corporation during the remainder of the lease, and a proposal to consider "as to the advisability, in the public interest, of adopting legal proceedings to terminate the lease between the Corporation and the company, in respect of its failure to implement its undertaking to provide an adequate service of cars in the city."

Lancaster.—The T.C. has decided to purchase and run three motor-'buses, for the accommodation of the workers at the new works now being erected in the town.

London.—At a recent inquest on the driver of an electric train, whose body was found in the tunnel at the Crystal Palace, it was mentioned that a wedge was found in the compartment of the train which he had in some way got out of, which might have served to render the so-called "deadman's handle" inoperative. The attention of the guard was drawn to the fact that something was wrong, by the train running at high speed through a stopping station, and he subsequently applied the brakes and stopped the train.

Northampton.—A statement as to the working of the tramways undertaking for the year to March 31st next shows an estimated balance of £4 594, which it is proposed to appropriate as follows:—To reserve fund, £2 600; to relief of rates, £1,500; balance to be carried forward (or the actual amount), £494. Application is to be made to the B. of T. to extend the period for exercise of the powers relating to trolley vehicles and tramway extensions not already carried out, as contained in the Corporation Act of 1911, for a further period of 12 months.

U.S.A.—The *Electric Railway Journal* states that the Interborough Rapid Transit Co., of New York, has ordered from the Westinghouse Co. a 70,000-kw. turbo unit for its Seventy-Fourth Street power station. The unit will be in three sections, one high-pressure and two low-pressure, and on light load it will be capable of operation at high economy with the high pressure and one low-pressure cylinder. The three electric generators of the unit will be of equal size, and at about 60,000 kw. will divide the load equally. The steam pressure to be used will be about 225 lb., and the superheat approximately 150° F.

The *Journal of Electricity* states that the electric towing "mules" at the Panama Canal have been modified, to allow of the two main induction motors being operated in cascade at half the speed for which the machines were designed; the speed of the "mules" is thus reduced from two to one mile an hour.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—May 1st. Two 300-kw. turbo-alternators, condensers, switchboard, &c., for the pumping station at Ryde, for the Metropolitan Board of Water Supply and Sewerage at Sydney.*

May 3rd. N.S.W. Railways and Tramways Department. One 2,500-kw. turbo-alternator, for Zara Street, Newcastle, power house. Specifications (20s.) from the Engineer's office, 61, Hunter Street, Sydney.*

Melbourne.—April 26th. Electrical equipment and accessories for sub-station for the Sandringham-Black Rock tramway.*

Aberdare.—March 11th. U.D.C. Electrical stores for 12 months. See "Official Notices" February 18th.

Belfast.—March 15th. Tramways and Electricity Committee. Stores, including a number of electrical items. See "Official Notices" February 25th.

Dundalk.—March 21st. U.D.C. Engine-room stores, cables, lamps, &c., for the Electricity Department. See "Official Notices" February 25th.

Dundee.—March 29th. Corporation. Electrical stores, meters, &c. Electricity Department, Dudhope Crescent Road.

Heston and Isleworth.—March 11th. U.D.C. Electrical supplies, including cables, meters, &c. See "Official Notices" February 25th.

Heywood.—March 15th. Electricity Committee. Stores, including some electrical items, for 12 months. See "Official Notices" February 25th.

London.—WESTMINSTER.—B. of G. Six months' supply of electric lamps, fittings, &c. Mr W. J. Lickley, Clerk, Guardians' offices, Princes Row, Buckingham Palace Road, S.W.

Manchester.—March 22nd. Electricity Committee. 6,600-volt three-phase switchgear, for Stuart Street station. See "Official Notices" to-day.

Merthyr Tydfil.—March 13th. Electrical accessories for six months for the B. of G. Mr. F. T. James, Clerk, 134, High Street.

New Zealand.—DUNEDIN.—May 17th. City Council. (1) Tramcar bodies; (2) electrical equipment. Plans, &c., from the Town Clerk, Dunedin.*

WANGANUI.—May 9th. Borough Council. Gas producer plant, gas engine, generator and switchgear.*

Pontypridd.—March 13th. U.D.C. Twelve months' supply of electrical stores for the Electric Light and Tramways Department. See "Official Notices" February 18th.

South Africa.—March 20th. S.A. Railways and Harbour Administration. 5,106 train-lighting cells.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London

CLOSED.

Barrow.—Corporation. Rotary converter and switchgear, British Thomson-Houston Co., Ltd., £2,760. The contract for 80 tons of coal per week—Pope & Pearson's washed smalls—at 19s. per ton delivered, has been extended for six months.

Croydon.—Corporation tramways. Wotan, tantalum, and carbon filament lamps for the year. Siemens Bros. Dynamo Works, Ltd.

Horsham.—U.D.C. Tender of the Electrical Apparatus Co., Ltd., for D.C. house-service meters for 12 months, accepted.

Leyton.—The Tramways Manager has purchased 10 tons 13 cwt. of steel tramway rails for £128. Messrs. B.I. & Helsby Cables, Ltd., have received a contract for trolley wire.

London.—BATTERSEA.—The Electricity Committee recommends acceptance of the following tenders:—

Oils, with the exception of turbine oils.—Price's Co., Ltd.
Packings.—Beldam & Co.
Consumers' fuse boxes.—British Insulated & Helsby Cables, Ltd.
Electrolytic meters.—Reason Manufacturing Co., Ltd.; Bastian Meter Co., Ltd.
Mercury meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.
Box compound.—Dussek Bitumen Co.
Troughing, conduits, bellmouths, &c., and way-bridges.—Callender's Cable and Construction Co., Ltd.
Coal.—Shipley Bright small nuts, Myers, Rose & Co., Ltd.; Pooley Hall small nuts, Foster & Co.

The Committee also recommends that no contracts be entered into at present for house-service boxes, &c., and watt-hour electricity meters.

BERMONDSEY.—The Electricity Committee recommends the renewal of the following contracts for annual supplies:—

Carbon brushes.—Morgan Crucible Co.
Cable.—C. Macintosh & Co., with the addition of 2½ per cent.
Insulating box compound.—Dussek Bitumen Co., subject to an increase of 8s. per cwt.
Conduits.—T. Wragg & Sons, with certain exceptions.
Joint boxes—Sykes & Sugden, plus 10 per cent.
Quotations for rubber and certain other cable and cut-outs will be obtained as required.

The Committee has purchased 80 tons of Welsh and picked steam coal out of contract from C. Franklin, at 37s. per ton for the Welsh and 31s. 9d. per ton for the steam coal, and has accepted the quotation of Babcock & Wilcox, Ltd., for fire doors, fire bars, &c.

L.C.C.—The Highways Committee has received the undermentioned tenders for the supply of 500 driving-wheel tires and 250 pony-wheel tires:—

	Driving-wheel tires.	Pony-wheel tires.
H. Bessemer & Co., Ltd. (accept d)	£38 10s. a ton, less 2½ per cent. dis.	£25 10s. a ton, less 2½ per cent. dis.
Cammell, Laird & Co., Ltd.	£38 10s. a ton.	£25 10s. a ton.

The cost of the tires is estimated at £7,200.

HACKNEY.—The Electricity Committee has received the following tenders for an auxiliary battery, &c.:—

	Price.	10 years' maintenance at per annum.
Battery.		
Hart Accumulator Co., Ltd. (accepted)	£251	£17 16 0
Tudor Accumulator Co., Ltd.	253	18 10 0
Chloride Electrical Storage Co.	257	18 10 0
D.P. Battery Co.	259	18 8 0
Charging Booster.		
Electromotors, Ltd. (accepted)		54 0 0
Crypto Electrical Co., Ltd.		56 0 0
Siemens Bros. Dynamo Works, Ltd.		58 0 0
J. H. Holmes & Co.		62 0 0
Special Switchgear.		
Nalder Bros. & Thompson, Ltd. (accepted)		93 0 0

ST. MARYLEBONE.—The Electricity Supply Committee recommends the acceptance of the following tenders:—

New economiser, £1,942.—E. Green & Son, Ltd.
Repairs to artesian-well pump.—A. C. Potter & Co.
Re-linking chain grate stoker, £115.—Babcock & Wilcox, Ltd.
Coal.—Charrington, Sells, Dale & Co., 1,600 tons of Langwith and Glapwell nutty slack, at 2 s. per ton, during the four months March to June inclusive. A. Blackmore & Co., 11,000 tons of Low Laithes Yorkshire washed nuts, at 24s. 9d. per ton, at the rate of 1,000 tons per month from August, 1916.

The Committee does not think it desirable to enter into contracts for general supplies for 12 months to March, 1917, and has limited the inquiries to supplies which will be required for six months only.

As regards small house cable, flexible cords, rubber goods and insulating material, the Committee considers that it would be advantageous to buy in the open market as and when required.

Underground cables.—B.I. and Helsby Cables, Ltd.

The Committee has taken advantage of the high prices ruling in the metal market to dispose of a quantity of scrap cable and also of some surplus stocks at profitable rates. Prices cleared: copper £106 per ton, lead £28 per ton, and sundry small cable (unstripped) £36 per ton.

METROPOLITAN WATER BOARD.—St. Helens Cable and Rubber Co., Ltd., V.I.R. cable and flex, £40; Simplex Conduits, Ltd., electric light fittings, £28.

WANDSWORTH.—The Guardians will not this year invite tenders for the supply of electrical fittings, &c., for set periods, but quotations will be obtained as required.

Southampton.—The Tramways Committee. Messrs. Edgar Allen & Co., points and crossings, £196.

Sunderland.—Electricity and Lighting Committees. Accepted tenders:—

Metallic packing.—Penman Metallic Packing & Engineering Co.
E.H.T. switchgear.—Ferranti, Ltd.
Governor valves.—Willans & Robinson, Ltd.
Creosoted wood troughing, &c.—Armstrong, Addison & Co.

Winchester.—Corporation electricity works. Alexander Duckham & Co., Ltd., engine and cylinder oils for a year.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 10th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Experiments illustrating "The Flow of Heat in Conducting Sheets," by Mr. S. Skinner; "The Absorption of Gas by a Quartz Vacuum Tube," by Messrs. R. S. Willows and H. T. George.

Manchester Association of Engineers.—Saturday, March 11th. At the Grand Hotel, Aytoun Street. Paper on "India-rubber and Balata Belting as Conveyer and Power-transmission Belts," by Mr. J. Tinto.

Royal Institution of Great Britain.—Saturdays, March 11th and 18th. At 3 p.m. At Albemarle Street. Lectures (I and II) on "Radiations from Atoms and Electrons," by Prof. Sir J. J. Thomson.

Thursday, March 16th. At 3 p.m. Lecture on "Organic Chemistry in War: Organic Products used as Propulsive and Explosive Agents," by Prof. H. E. Armstrong, F.R.S.

Belfast Association of Engineers.—Wednesday, March 15th. Paper on "Civil and Military Engineering under the Roman Empire," by Mr. A. McI. Cleland.

Faraday Society.—Wednesday, March 15th. At 8 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Informal discussion on "Methods and Appliances for the Attainment of High Temperatures in the Laboratory," opened by Dr. J. A. Harker, F.R.S.

Nottingham Society of Engineers.—Wednesday, March 15th. At 7.30 p.m. At the Welbeck Hotel, Milton Street. Paper on "Brass Foundry Practice," by Mr. H. L. Reason.

Institution of Electrical Engineers.—Thursday, March 16th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The use of Continuous Current for Terminal and Trunk Line Electrification," by Mr. N. W. Storer.

(Students' Section).—Wednesday, March 15th. At 7.45 p.m. At the I.E.E., Victoria Embankment. Adjourned discussion on "Suggested Applications of Science in Warfare."

(Birmingham Local Section).—Wednesday, March 15th. At 7 p.m. At the University, Edmund Street. Mr. J. S. Peck will read Mr. N. W. Storer's paper on "The use of Continuous Current for Terminal and Trunk Line Electrification."

(Scottish Local Section).—Tuesday, March 14th. At 8 p.m. At 207, Bath Street, Glasgow. Kelvin Lecture on "Terrestrial Magnetism," by Dr. C. Chree.

Chemical Society.—Thursday, March 16th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Institution of Mechanical Engineers.—Friday, March 17th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Composition of the Exhaust from Liquid-fuel Engines," by Second-Lieut. R. W. Fenning, R.E. (T).

Greenock Electrical Society.—Friday, March 17th. At 7.45 p.m. At the Temperance Institute, 19, West Stewart Street. Papers on "Some D.C. Diagrams of Connections," by Mr. D. Angus, and "Heating and Ventilation," by Mr. W. A. Toppin.

Electro-Harmonic Society.—Friday, March 17th. At 8 p.m. At Holborn Restaurant. Smoking concert.

NOTES.

L.C.C. Committees.—The L.C.C. is recommended to confirm the appointment of the members of the following Committees for 1915-16 :—

Highways Committee.—Sir John Benn, D. Davies, G. M. Gillett, A. O. Goodrich, W. Haydon, D. Hazel, T. F. Hobson, G. H. Hume, W. Hunt, H. Marks, Capt. T. Prestige, A. H. Scott, P. C. Simmons, W. J. Squires, H. Ward and A. W. Yeo.

Stores and Contracts Committee.—W. H. Ecroyd, W. Haydon, W. C. Johnson, Miss A. S. Lawrence, O. Lewis, H. Marks, H. Parsons, I. Salmon ; the Education, Fire Brigade, Highways, Drainage, and Parks Committees have each to elect a representative.

Foreign Trade.—THE FEBRUARY FIGURES.—The following are the electrical and machinery figures given in the official returns for February :—

	Month of February.	*Inc. or dec.*
IMPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	£96,494	+ £27.416
Machinery	613,691	+ 40,158
EXPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	298,638	+ 124,768
Machinery	1,524,653	+ 238,785

The Electric Vehicle Committee.—At a meeting of the Electric Vehicle Committee on February 18th, the increasing circulation of the official publication was commented on. The Committee had before it a letter from the secretary of the Electric Vehicle Association of America, offering every assistance in helping forward the movement.

The Committee has accepted an invitation by the Society of Motor Manufacturers and Traders to nominate a representative to sit upon the Tire Research Committee, which has recently been appointed to investigate all technical matters concerning rubber tires.

The Committee considered a communication from the Accumulator Manufacturers' Section of the B.E.A.M.A., stating that it was prepared to agree to the standard sizes and rating as set forth below. These will be known as E.V.C. standards, but it is hoped that, in due course, the British Engineering Standards Committee may give them the mark of approval by adopting them as British standards.

"*E.V.C.*" *Standard Rating.*—This shall be the capacity in ampere-hours obtained by a continuous discharge at a uniform rate for a period of five hours until the voltage of the cell falls to 1·7. Example : If a battery is specified to have an "E.V.C." standard rating of 180 ampere-hours, it means that the battery will give this capacity when discharged at a continuous rate of 36 amperes for a period of five hours, at the end of which time the voltage per cell shall not have fallen below 1·7 volts.

"*E.V.C.*" *Standard Plates.*—Height, 8⅜ in. ; width, 5¼ in. ; lug centres, 4⅜ in.

"*E.V.C.*" *Standard Overall Sizes.*—For all sizes the width of the cell shall be $6\frac{7}{16}$ in. and the overall height, including connector, 14⅜ in. The length of the smallest size, *i.e.*, that with seven plates, shall be $2\frac{7}{16}$ in., with the addition of ⅜ in. for each pair of plates above seven plates.

An exception is made in the case of the Chloride Accumulator Co.'s "Ironclad-Exide" type of cell, in connection with which the length of the seven-plate size is 2⅝ in., with the addition of ⅜ in. for each pair of plates above seven plates.

"*E.V.C.*" *Standard Inspection Plug.*—Shall be that which will fit a hole in the cover of the cell 1 in. in diameter.

"*E.V.C.*" *Standard Charging Voltage.*—Shall be that which is suitable for charging 44 lead-acid cells, *i.e.*, 85 to 120 volts.

The Committee has had brought to its notice difficulties which are being experienced in a few of the districts bordering upon the London area by electric delivery vehicles, operating from London on long delivery routes, in getting boosting charges. The difficulties consist in either delay in getting connected up for charging owing to there being no permanent connection for the purpose, or, on the other hand, the exhorbitant price charged for the service. The Committee appeals to all central station engineers to adopt, where they have not already done so, the Committee's standard tariff of 1d. per unit for "off peak" charging, with a minimum of 2s. per charge (24 units at 1d.), to include all connecting-up and disconnecting. At first, all that is necessary is a permanent (for the time being) connection from the switchboard bus-bars through a D.P. switch and fuses, or a maximum overload circuit-breaker, through an adjustable water resistance to a British standard charging-plug. If, perchance, there is a booster set, or an exciter in the station, giving about 120 volts, that can be used for this purpose when required, so much the better. The proper and permanent charging plant can be put in when the first car is put into permanent use in the district.

Glass Telegraph Poles.—According to the *Journal Télégraphique*, reinforced glass telegraph poles are being made in Germany for use in the Tropics and elsewhere, as being immune from the attacks of white ants, &c., and proof against climatic influences, and more lasting than wood. The poles are cast in moulds, in which is a fine network of steel, the combination yielding a product of great strength.

Red Cross Concert.—In the streets of London the afternoon of Saturday last was cold and raw, but in the King's Hall of Holborn Restaurant was warmth and light and friendliness, for the Junior Institution of Engineers were gathered for a Bohemian concert "in aid of the funds of the Red Cross Hospital of the City of London Branch of the British Red Cross Society." Sir Boverton Redwood, Bart. (Past President), was in the chair, supported by the Lord Mayor. The artistes were as follows :—Soprano, Miss Ethel Williams ; contralto, Miss Mary Williams ; baritone, Mr. Archie Anderson ; elocutionist, Miss Frances Edmonds ; royal campanologist, Mr. Wilfrid Alderton ; cornet soloist, Mr. Chas. Leggett ; living marionettes, Mr. Arthur J. Hill ; character sketches, Mr. Ernest Cherry ; humorous songs, Mr. Walter Montagu. Accompanists, Mr. R. Cooper and Mr. Fred. Froud. Hon. musical director, Mr. Geo. T. Bullock. The thanks of the Institution were proffered to Sir Boverton Redwood by Mr. Tookey. The Lord Mayor arrived early, and made, just before the interval, a brief speech. He introduced Mr. Richard Davies, Chairman of the City of London Branch of the Red Cross Society, who had a silent and very attentive and sympathetic audience to listen to his interesting account of the hospital, and his tactful appeal for aid. Although not in the programme, mention must not be omitted of a bevy of nurses in blue and white with the Red Cross badge, who dispensed programmes in return for donations to the hospital funds. The audience numbered 646.

Institution and Lecture Notes.—The Faraday Society.—The Society will hold an informal discussion on "Methods and Appliances for the Attainment of High Temperatures in the Laboratory," on Wednesday, March 15th, at 8 p.m., at the Institution of Electrical Engineers, Victoria Embankment, W.C. Dr. J. A. Harker, F.R.S., of the National Physical Laboratory, will open the discussion, over which Sir Robert Hadfield, F.R.S., the President of the Society, will preside. Workers interested in the subject, and particularly those prepared to speak on the results of their personal experiences, are invited to be present and take part in the discussion. Further particulars may be obtained from Mr. F. S. Spiers, secretary to the Society, 82, Victoria Street, London, S.W.

Institute of Metals.—The sixth annual May lecture will be delivered, on May 4th, by Prof. W. H. Bragg, the subject being "X-rays and Crystal Structure, with Special Reference to Certain Metals."

The Institution of Electrical Engineers.—On Wednesday an "informal general meeting" of Corporate Members was held to consider the question of the expulsion of alien enemy members from the Institution. There was a large attendance. After reading a number of letters from provincial members supporting the proposal, and others on the contrary, the President stated that before calling a special general meeting to vote on the question of altering the Articles of Association, the views of the members as a whole would be ascertained by a post-card plebiscite—not a postal ballot, which was not practicable. The meeting then proceeded to discuss the various aspects of the subject at considerable length, the sitting lasting for 2¼ hours. The main difficulty centred in the question whether a differentiation should be made between naturalised members of alien enemy origin and unnaturalised alien enemies, owing to the uncertainty as to the *bona fides* of naturalised Germans, who, if naturalised since January 1st, 1914, may, under a new German law, retain their German nationality. Eventually the President put a series of questions to the vote :—Should the voting be by ballot? Should subjects of enemy countries be expelled? Should naturalised aliens who had retained their original nationality be expelled?—all of which were carried by show of hands with hardly any dissentients. The question whether naturalised British subjects who had been subjects of a State now at war with this country, but were able to prove to the satisfaction of the Council that they had lost their orginal nationality, should be expelled, was answered by an overwhelming majority in the negative, and the question whether subjects of enemy countries should be barred from election in the future was carried by two to one. A Committee of Members, consisting of Messrs. Atkinson, Swinton, Gill and Rider, was then appointed to meet the Vice-Presidents (Messrs. Highfield, Russell, Smith and Wordingham) and decide upon the form of a resolution to embody the principles which had thus been laid down.

At the meeting of the YORKSHIRE LOCAL SECTION on Wednesday last a paper was read by Mr. Henry Joseph on "The Hire and Maintenance of Continuous-current Motors."

The Committee of the WESTERN LOCAL SECTION has put forward the following nominations for the vacancies which will occur at the end of the present session :—Chairman, Dr. David Robertson, Bristol ; vice-chairman, Mr. R. Howard Fletcher, Cardiff. Seven nominations to fill five places on the Committee :—Messrs. F. S. Carter, Port Talbot ; W. D'A. Madden, Bath ; T. Mills, Melksham ; C. G. M. New, Cardiff ; C. F. Proctor, Cardiff ; H. I. Rogers, Bath ; A. L. Stephens, Stroud.

Diesel Engine Users' Association.—At the February meeting a discussion took place on the use of tar oils as fuel for Diesel engines ; Mr. W. Batho, of Messrs. Sulzer Bros., and Mr. L. W. Johnson, of Messrs. Banks, Warner & Co., Ltd., who had been specially invited to attend, contributed detailed statements on the subject, and in the discussion which followed stress was laid on the importance of rendering users of Diesel engines in this country independent of the use of imported petroleum fuel oils, and of utilising the mineral resources of the country. The next meeting will be held on the 22nd inst.

A Diary of Electric Railway Operation.—A recent issue of the *Railway Review* contains an abstract of a memorandum in diary form of the inauguration of electric service between Three Forks and Deer Lodge, Mont., by the Chicago, Milwaukee and St. Paul Railway.

Reference occurs under date, December 2nd, 1915, to the running of a 1,016-ton train from Butte to Three Forks; it was calculated from the electric locomotive meter readings that the cost of handling this train from Butte to Donald, for power, was $9; on the same basis the amount of power returned to the line from regenerative braking between Donald and Piedmont amounted to $5, leaving the net cost of handling the train from Butte to Piedmont at $4.

Under date December 7th, it is mentioned that a constructional pipe in Tunnel 11, being too near a 3,000-volt feeder, a short circuit resulted burning off one feeder, steel messenger, and two trolley wires about 800 ft. from the tunnel entrance. While attempts were being made to find the trouble, a freight train passed through the tunnel, caught the loose ends of the overhead structure and practically tore the whole thing down. Twenty men repaired this during the next 24 hours.

On December 8th, a comparison was made between two electric locomotives hauling 3,000 tons and three steam locomotives hauling 2,200 tons; the former maintained an average speed of 16 M.P.H. on a 1·66 per cent. grade, while with the latter on the same road the speed was estimated to be between 9 and 10 miles an hour. The maximum A.C. demand noted during the test was 6,200 KW., and the maximum D.C. demand, 5,400 KW. showing an efficiency of combined motor generator sets of 87 per cent.

The memoranda cover the 10 days prior to opening the line for regular service, and the only other troubles worth recording were changing sliding members of pantograph owing to wear by trolley wire, due to its being roughened with soot and smoke; also damage to overhead structure and pantograph owing to the latter passing a trolley wire terminal. Regular operation commenced on the tenth day.

Tahiti.—According to the *Journal Télégraphique*, the French Government is installing a temporary wireless station at Tahiti, in the Society Islands, which will shortly be opened for traffic. The installation will be provided with plant of 10 KW., and will be able to communicate with New Zealand, Fiji, and Samoa. As soon as the temporary station is ready, work will be commenced on a permanent station of 300 KW., which will probably be able to communicate with Cochin China, South America, Honolulu, San Francisco, and Sydney.

Volunteer Notes.—ENGINEERING INSTITUTIONS' V.E.C.—Orders for week commencing March 13th, 1916.—By Lieut.-Col. C. B. Clay, V.D., Commanding.

Saturday, March 11th.—Parade, Putney Bridge Station, 3 p.m.
Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, March 13th.—Sections 1 and 2, Technical; Sections 3 and 4, Lashings and Trestle Bridging, Signalling Class and Recruits.

Tuesday, March 14th.—School of Arms, 6 to 7 p.m.

Thursday, March 16th.—Shooting for Sections 3 and 4.

Friday, March 17th.—Sections 3 and 4, Technical; Sections 1 and 2, Lashings and Trestle Bridging; Signalling Class and Recruits.

Saturday, March 18th.—Adjutant's Instruction Class at 2.30 p.m.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, March 9th, 1916:—

Week-end Parades.—Saturday.—The Battalion will parade at Wembley Park at 3.15 p.m. for drill under Company Commanders. "Derby" Recruits are invited to attend.

Sunday.—The Battalion will parade at Liverpool Street Station (low-level entrance, G.E.R.) at 9.30 a.m., and proceed by train for Entrenching duties. Members will carry their own lunch. The Battalion will return to town about 6 p.m.

Musketry.—There will be a shooting match at Bisley on Saturday next, the 11th inst., between Sergeant R. C. Davis's "A" Company team, and Acting Company Sergeant-Major Harper's "B" Company team. Targets will also be available at Bisley for other members of the Corps desirous of shooting.

All men proceeding to Bisley should report themselves to Sergeant Cotter, at the barrier of No. 6 Platform, Waterloo Station, at 12.45 p.m.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Electric Power in Russia.—It is reported from Petrograd that a special commission, composed of representatives of the Government, commerce and industry, will meet shortly to examine the Bill prepared by the Ministry of Commerce to facilitate the development of the use of electric power in works and factories. The Bill has been prompted by the frequent crises in connection with the supply of coal in the country.

Appointments Vacant.—Shift engineers, junior engineers and attendants, station fitters, engine drivers (steam, oil and petrol), stokers and trimmers, linemen, wiremen, mates and labourers, for the Northern Command: engine driver, Llandudno electricity works; switchboard attendant, Borough of Nuneaton electricity works; resident assistant engineer, 3 r, 64 . for the Bethnal Green Military Hospital. See advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—A smoking concert was recently held in the banqueting-room of the City Hall, Cape Town, for the purpose of making a presentation to Mr. W. F. LONG on his retirement from the position of city electrical engineer. The Town Clerk presided, and was supported by many of the City Councillors. The presentation took the form of a magnificent piece of plate. In connection with Mr. Long's retirement and the promotion of Mr. S. J. CLUNAS, the present station manager, to the position of acting city electrical engineer, Mr. PURVIS, who has been Mr. Clunas's assistant for some years, has been appointed station manager.

Winchester T.C. has appointed Mr. REGINALD AYTON engineer and manager of the electricity undertaking at £400 a year, increasing by £50 a year. For five years he has been resident engineer under the consulting engineers.

The Belfast Corporation has adopted the recommendation of the Tramways Committee "That Mr. A. NANCE be relieved of his duties as general manager of the Corporation tramways undertaking as and from September 1st, 1916, and appointed as consultant to the undertaking at a salary of £500 per annum."

Mr. J. W. DUGDALE, general manager of the Oldham Corporation tramways, has resigned his post.

Nelson Corporation has advanced the salary of Mr. WM. THOMPSON, station superintendent.

Peterborough T.C. has increased the salary of the acting electrical engineer from £3 10s. to £4 per week.

General.—Mr. W. H. PATCHELL has just removed his offices to 64, Victoria Street, London, S.W.

The prize of £10 and a silver medal, offered under the Peter Le Neve Foster Trust by the Royal Society of Arts, for an essay on "Zinc, its Production and Industrial Applications," has been awarded to Mr. J. C. MOULDEN, A.R.S.M., M.Inst.M.M. Honourable mention has also been awarded to Mr. E. A. SMITH, A.R.S.M., M.Inst.M.M., Deputy Assay Master of the Sheffield Assay Office.

Sub-Lieutenant JOHN KAYE, an electrician in the R.N.V.R., was married at Dunfermline last week to Miss Margaret Summerville, of Viewfield, Dunfermline. Sub-Lieut. Kaye formerly held a position at the Ashton electricity station, and recently was engaged at Dunfermline.

It will be remembered that the members of the board of the Manchester Chamber of Commerce resigned in a body a fortnight ago upon the rejection of a report expressing the views of the board on the question of trade after the war. For the new board 29 names have been nominated for 22 seats, and among them is Mr. HARRY VERNON KILVERT, electrical engineer, of the Lancashire Dynamo and Motor Co., Ltd.

In the list of aliens to whom letters of naturalisation were granted during February are the following:—W. B. Rommel (U.S.A.), London, consulting engineer; A. Sild (Russia), London, electrical and mechanical engineer.

Mr. S. MCFADDEN, traffic manager at the Norwich Telephone Exchange, who is leaving to take up an appointment at Bournemouth, has been presented by the staff with a china cabinet.

Mr. T. GLADDY, who for the past eight or nine years has had charge of the accessories section of the supplies department of Messrs. Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames Street, E.C., is shortly leaving that firm to take up an appointment as commercial manager with Messrs. Trevelyan & Co., manufacturers of electrical and general engineering accessories, at 155, Bracebridge Street, Birmingham.

Mr. PAKENHAM W. BEATTY has resigned his position as chief engineer to the Lacroze Tramway Co., of Buenos Aires, which he has held since June, 1913, in order to take up the post of chief engineer to the Buenos Aires Underground Railway, belonging to the Anglo-Argentine Tramway Co., of Buenos Aires.

We are informed that the arrangements which existed between Mr. CHAS. PULLAN, consulting electrical engineer, and Mr. C. H. BEST, accountant, both of Bradford, who had been for some time co-operating in connection with a number of village electric supply schemes, came to an end on February 4th. These two gentlemen will in future work quite independently of each other.

SIR H. LLEWELLYN SMITH is to resume active duty as Permanent Secretary to the Board of Trade. Mr. W. F. MARWOOD, C.B., has been appointed Second Secretary to the Board. These changes are consequent upon the departure of Sir G. BARNES for India to take up the position of Commercial Member of the Viceroy's Council.

Roll of Honour.—Rifleman A. J. SCOTT, 1st Surrey Rifles (21st London Regiment), a clerk in the St. Marylebone electricity department, was killed in action on January 23rd.

Torpedoman DODSON, who was awarded the D.S.M. for gallant service, recently visited his home in Accrington. It will be remembered the *Königsberg* was chased by British warships, and sought refuge in a river. While under fire Dobson (who held the position of electrician on his ship, hav-

ing charge of the lighting, &c.) played a prominent part in preventing the German cruiser escaping.

Private J. Holliday, who has been killed in action, was employed at Blackburn electricity works.

Corporal P. J. Adamson, whose death has occurred, at Cairo, was well known in Rochdale as an electrical engineer. He was formerly employed at generating stations at Radcliffe and Middlesbrough, and on his return to Rochdale joined his eldest brother, Mr. G. L. Adamson, in the Ohm Electrical Works. He met his death in Egypt while engaged in fixing telegraph apparatus on the railway line, being knocked down by a train.

Private Leonard Wood, of the 10th Lancashire Fusiliers, who, prior to the war, was employed by the Lancashire Electric Power Co., has been killed in action.

Obituary.—Mr. R. A. Dawbarn.—We learn with deep regret that Mr. Robert Arthur Dawbarn, M.Inst.C.E., M.I.E.E., of Westminster, passed away on March 6th at the age of 55 years. Quite recently he suffered a complete breakdown in health, and his death occurred at a nursing home. After serving an engineering apprenticeship, and undergoing training at Glasgow, he, 35 years ago, entered the service of the British Electric Light Co., the owners of the Gramme patents. After three years he was employed on ship lighting work carried out by Mr. Raworth, and next spent a couple of years on Messrs. Siemens's electric light staff at Woolwich. He later returned to Mr. Raworth, who was then superintending engineer to the Brush Co., and while with this company he was responsible for the details of many Brush electric lighting schemes. He did not limit his attentions to this country, for, as a matter of fact, certain of his Brush activities took him to Australia, where he amalgamated several electrical concerns, and studied electrical affairs generally. Some 16 years ago Mr. Dawbarn left the service of the Brush Co. and joined Mr. W. M. Mordey in partnership, in the business of Mordey and Dawbarn, consulting engineers. He was in this capacity engaged at different times upon various public and other electrical projects and works, and the firm's operations frequently took him on visits to South America, South Africa, and elsewhere. Mr. Dawbarn was a man who until quite recently betrayed no signs of giving out, and we must reckon him among those who have succumbed to the stress and strain of trying years before the completion of what seemed to be the allotted span. His death will be regretted by a large circle of friends in the electrical world, and we tender our sympathy to his partner, Mr. W. M. Mordey.

Will.—The late Mr. Z. Merton (H. R. Merton & Co.) left £149,865 gross and £121,889 net.

NEW COMPANIES REGISTERED.

Company of Electric Caterers, Ltd. (143,181).—This company was registered on March 3rd, with a capital of £1,500 in £1 shares, to carry on the business of bakers, confectioners, and millers, dealer in flour, meal, and other breadstuffs, corn merchants, suppliers of refreshments, caterers, manufacturers of and dealers in aerated and mineral waters, tea, coffee, cocoa, and chocolate, grocers, tea dealers, &c., to conduct the business of the company for the benefit of the ticket holders, or associated as well as of the shareholders; to provide a public hall in the parish of Hendon or elsewhere, and to adopt an agreement with H. S. Cooper and A. G. Raymond. The subscribers (with one share each) are: H. Crump, Quarndon, 8, Ashbourne Avenue, Golders Green, N.W., chartered surveyor; J. M. Lickfold, Cross Roads House, Golders Green, N.W., solicitor. Private company. The number of directors is not to be less than five or more than nine; the first are H. S. Cooper, A. G. Raymond, W. L. Raymond, H. Crump, B. G. Drummond, H. A. Welch, and J. M. Lickfold. Registered office: The Refectory, Finchley Road, Golders Green, N.W.

Launa British Electrical Co., Ltd. (143,140).—This company was registered on February 28th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and general manufacturers and contractors, designers, makers and producers of electrical glow lamps, appliances, fittings, cables, tubes, liquid, and solid compositions, powders, and flexible wires, &c. The subscribers (with one share each) are: D. Schofield, 208, Lauderdale Mansions, Maida Vale, W., advertising contractor; F. O. Langton, 61, Call Lane, Leeds, builders' merchant. Private company. The number of directors is not to be less than two or more than five; the first are F. Dove (permanent governing director) and D. Schofield. Qualification, £20. Secretary: M. J. Dove, 78, Louis Street, Leeds. Registered office: 61, Call Lane, Leeds.

Caton Electric Supply Co., Ltd. (143,150).—This company was registered on February 29th, with a capital of £2,000 in £1 shares (1,000 6 per cent. cum. pref.), to carry on at Caton and elsewhere the business of an electric light and supply company in all its branches. The subscribers (with one share each) are: C. H. Best, 72, Market Street, Bradford, incorporated accountant; J. T. Walker, Brookhouse, Caton, grocer, &c.; T. H. Mattinson, Caton, near Lancaster, boot and shoe store keeper; N. A. Foster, 1, Cheapside, Bradford, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are C. H. Best and N. A. Foster. Qualification, 25 shares. Solicitors: Gaunt, Foster & Co., 1, Cheapside, Bradford. Registered office: 72, Market Street, Bradford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Strode and Co., Ltd.—Particulars of £4,000 prior lien debentures, created February 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, ranking in priority to £15,000 existing debentures, and a further issue of £2,500 like debentures. No trustees.

CITY NOTES.

Harrow Electric Light & Power Co., Ltd.

During 1915 80 new installations (126 kw.) were connected. The consumers now number 1,794, taking 1,862 kw. (aggregate), and the output for the year was 530,107 units. The net revenue balance, after deducting debenture interest and the interim preference dividend, was £2,402. The final preference dividend absorbs £375, 5 per cent. is to be paid on the ordinary shares, and £360 carried forward. At the annual meeting on February 22nd, Mr. J. N. Stuart, the chairman, said that in spite of the lighting restrictions the sales showed a falling off of only 8,000 units, about 1½ per cent., which had been almost compensated for by a slight alteration in the method of charging during the past half-year. As long as the war continued they must be satisfied if they could hold their own. He could offer no great prospects for the coming year; they would do their best to maintain the dividend until brighter days, and therefore brighter nights, came for the country. Mr. G. Spencer Hawes seconded, and said that for eleven consecutive years they had maintained their 5 per cent. dividend.

Waste Heat and Gas Electrical Generating Stations, Ltd.

For the year ended January 31st, 1916, the profit, after deducting administration expenses, was £39,819 (last year £39,001). There has been transferred to the credit of reserve account £11,000. The balance brought forward was £14,212, so that the available profit is £43,030, as compared with £40,612 for 1914. After paying 8 per cent. on the ordinary shares, as in the previous year, £17,430 is to be carried forward. The balance of the dividend now being paid is to be paid less income-tax. Additional plant for Weardale power station is making satisfactory progress at the manufacturers' works, and extensions to Grangetown power station will be completed three or four months' hence. The supply of waste heat and gas, and consequently the output of electrical energy, has been less than in 1914. The costs, however, have been less owing to the smaller amount paid to the owners of the collieries and ironworks. The company took up £10,000 4½ per cent. war loan, and exchanged its 3½ per cent. War Loan into 4½ per cent. Annual meeting: March 8th.

Lancashire United Tramways, Ltd.

Presiding at the annual meeting on February 29th, the Hon. Arthur Stanley, M.P., referred to the satisfactory result of the working for the year, notwithstanding the increase in expenditure caused mainly by the extra cost of materials, war bonuses to employés, and amounts paid to dependents of men with the Forces. 130 men were serving in the Colours, but up to the present the usual service of cars had been maintained through the employment of female labour, which was proving satisfactory. Since the early days of the war the staff and employés had made a regular monthly contribution to the funds of the British Red Cross Society, averaging over £25 per month, and amounting in all to over £360. Mr. Stanley (who is Chairman of the Joint War Committee of the British Red Cross Society and the Order of St. John of Jerusalem in England) took the opportunity of publicly thanking all those who had thus so generously helped in the work of transporting sick and wounded soldiers.

British Engine, Boiler, and Electrical Insurance Co., Ltd.

Presiding at the annual meeting, held at Manchester last Friday, Mr. R. C. Longridge commented on the substantial growth in income from inspection charges and premiums in all the principal departments of business, amounting to £117,112, against £112,465, which, occurring in the first year of management of Mr. Harry M. Longridge, gave great satisfaction, especially having regard to the disturbance of business conditions and the absence of 44 members of the staff with the Colours. The profit showed a slight reduction, outgo being a little in excess of the average owing to the increased cost of repairs and to a war bonus payment to the staff, while the company's charges remained unaltered. Provision was made for carrying £5,000 to reserve for current risks and writing £7,250 off investments and furniture, leaving a balance of £11,521, and after providing for the final dividend, the total funds amounted to £177,025.

Electrical Distribution Co. of Yorkshire, Ltd.

Mr. R. W. Wickham, presiding at the annual meeting on February 29th, said that in view of the increased costs, the lighting restrictions, and other difficulties due to the war, the results were very satisfactory. The capital expended during the year was £6,173; the policy of restricting such expenditure would, under the circumstances, be continued. The consent of the Treasury was being sought to make a further issue of capital, and, if approval were obtained, a *pro rata* allotment to present holders would be made. The last issue was over-applied for. They believed that future years would show the same steady progress as in the past. The new lighting restrictions would doubtless further affect the revenue, but their conservative policy would enable them to overcome present difficulties without any serious effect upon the year's trading.

Bournemouth and Poole Electric Supply Co., Ltd.

During the year 1915 the revenue, after deducting generating and distribution costs, rent, rates, taxes, wages, &c., is £38,684, plus £3,829 brought forward. Debenture and other interest absorb £11,373, there is put to reserve for depreciation £8,000, 4½ per cent. is paid on the first and 6 per cent. on the second preference shares, also 6 per cent. on the ordinary, £3,607 remaining to be carried forward. The total applications received amount to 10,549 KW., an increase of 885 KW. for the year. The units sold for all purposes numbered 4,061,091. Units generated, 5,482,458; 161 public lamps used 9,034 units. The dividend declared by the Richmond (Surrey) Electric Light & Power Co., Ltd., was 6 per cent. on the ordinary shares.

India-Rubber, Gutta-Percha, & Telegraph Works Co., Ltd.

A circular has been issued to the debenture and shareholders respecting the £400,000 4 per cent. first mortgage debentures, which fall due for payment on March 25th. It is proposed (the Treasury raising no objection) to make a new issue of 4,000 first mortgage debentures of £100 each at 5 per cent. at the price of 93, repayable at £100 in March, 1926. Holders of the existing debentures will have the preferential right of taking up the new issue to the amount of their present holdings, so that each holder who exercises that right will receive a new £100 5 per cent. debenture and a payment of £7 in cash per £100 now held. The directors ask the shareholders to support the scheme, and point out that it is to their interest to make it a success. It is important that the company should not be hindered in its operations, and it is difficult for any company to raise fresh capital at present.

Northampton Electric Light and Power Co., Ltd.

Presiding at the annual meeting on March 2nd, Ald. F. H. THORNTON welcomed the shareholders to the new offices. The meeting was held in the new demonstration room. The company had experienced a very strenuous year. Twenty per cent. of the outdoor staff and 45 per cent. of the indoor staff had enlisted, and a great deal more work had devolved upon those who had been left behind. The company was supplying more motor power than ever before, and if it had not been for the fact that they were able to install it within 24 hours many shoe manufacturers would not have been able to complete their Government orders. Therefore they had not only served the town well, but also their country. The site for the erection of a new generating station was one of the most important that could have been obtained; it would give river water for cooling purposes, and they would be able to expand as necessity arose. The fact that the Town Council had now consented to allow them to take the mains along the towing path, the nearest route to the town, had saved them several hundreds of pounds. The site was rather subject to floods, but that would be got over by raising the works above the level of the floods. As to when they would go on with the erection of the station, that depended altogether upon circumstances. They had made arrangements to add another large engine to the works, but that could be put in at the present station or at the new one, as was most convenient. Alternating current would be generated at the new station, and it would be transformed at the present station. They did not raise the price of current until nine months after the Gas Co. had raised the price of gas, and not until a long time after many other companies in the country. That was due to the very advantageous coal contracts they had secured. 85 per cent of the current they supplied was for motor power. The board of directors proposed that Mr. A. E. Marlow, J.P., a prominent boot manufacturer, should be added to their number.

Telegraph Construction and Maintenance Co., Ltd.

At the annual meeting, on March 2nd, Sir JAMES PENDER, who presided, referred to the loss that the board had sustained by the resignation of Lord Selborne consequent upon his having accepted office in the Government. The profit for the year was £108,708, as compared with £109,186 for 1914 and £114,863 for the year before the war. Adding £111,406 brought forward, they had a total of £220,114. After paying dividend and bonus of 36s. per share, in addition to 12s. per share interim dividend already paid, and putting £20,000 to the reserved fund, £110,474 was to be carried forward. The past year had been far from normal. Contracts entered into before the war began had to be postponed on account of urgent Government requirements, and it was not until many months had elapsed after the contract dates that they were able to complete the work which they had undertaken. They had much for which to thank their clients in the way of patience and forbearance in face of the serious inconvenience to which they had been subjected by these delays. They had been working under exceptional difficulties all the year, both on account of scarcity of labour and shortage of supply of materials, and ever-increasing prices of both, but they had managed to keep their manufactured output quite up to the average of previous years. They had done a good deal of work for the Government as well as their ordinary business. Their profits had been comparatively small, rather less than last year, and considerably less than the year before the war, so they would have no excess war profits to return as payable under the Finance Act; in fact, but for the good rates of interest which they had been getting for money, and the profit realised on the sale of some American dollar securities, they would not have been able to show so good a result. Their ships had been actively employed throughout the year and had often had to carry on their work within the danger zone, but, thanks to the foresight of the Admiralty and their provision of the naval escort which was necessary for protection, the ships had gone through the year without any mishap.

London United Tramways, Ltd.

The gross receipts in 1915 were £300,166. After adding the balance brought forward and deducting all expenses chargeable to revenue, including an appropriation of £25,000 to reserve for reconstruction and renewals, there remains £2,327, which is to be carried forward. The reconstruction of the line between Brentford and Hounslow, commenced in 1914, was completed, and the entire cost of the work has been charged against the reserve for reconstruction and renewals. The car-repair work previously carried out at the Chiswick Depôt has been removed to other depôts. Passengers carried 63,145,226, as against 61,433,783 in 1914; car miles run 7,744,894, as against 8,996,891; average receipts per passenger 1.21d., as against 1.17d. Annual meeting: March 13th.

London and Suburban Traction Co., Ltd.

The revenue for 1915, consisting almost entirely of dividends and interest receivable from the subsidiary companies, amounted to £122,430, as against £118,580 for 1914. After deducting all expenses chargeable to revenue, including debenture and loan interest, and providing for the sinking fund charges on the 5 per cent. debenture stock, £80,755 remains, plus £2,886 brought forward. After paying the full dividend on the 5 per cent. cum. pref. shares, £3,483 remains to be carried forward. During the year £9,317 5 per cent. debenture stock was purchased and cancelled under the operation of the sinking fund provided for in the trust deed constituting the stock, thereby reducing the amount outstanding to £338,683. Annual meeting: March 15th.

Tramways, Light & Power Co., Ltd.

VISCOUNT CHILSTON presided on February 29th at the annual meeting, and said that they had represented in the accounts a full year's trading under war conditions. Notwithstanding the difficulties due to the war, the companies in which they were interested had made progress, but the progress was largely counteracted by progressive increases in the cost of production, and particularly in the cost of fuel. They were of opinion that they had lived through their worst year in 1915. The various undertakings had only to continue the present rate of earnings to show a considerable increase during the current year, and the increase should continue for some time unless, after peace was declared, a very substantial change for the worse came over the country. The Derbyshire and Nottinghamshire Electric Power Co. developed slowly during the year, but the increased receipts were rather more than offset by increased costs, the net receipts being about the same as in 1914. During 1916 increased returns would be derived from this company from business connected last year too late to affect the return for that year. The Leicestershire and Warwickshire Electric Power Co. last year showed considerable improvement, and during the last few months of the year a substantial increase in net earnings. Judging by present results, this property would contribute a substantial increase during the current year to the revenue of this company. Last year he said that a large additional revenue could be earned from the money already expended on the power properties, and this statement had been amply justified during the year, additional consumers having been connected to the Power Companies' mains equal to about £10,000 receipts per annum. Their various properties showed a substantial increase in earnings for the present year to date compared with the corresponding period of 1915. They might reasonably hope, therefore, that the current year, unless something very unforeseen occurred, would show a satisfactory increase over last year.

Metropolitan Electric Supply Co., Ltd.

The capital expenditure during 1915 was increased by £30,142. The gross revenue was £229,201, an increase of £13,656; working expenses £127,150, an increase of £12,538. The balance at the credit of the revenue account before providing for depreciation is £102,051. £27,000 has been set aside as an addition to the depreciation and reserve fund, which, after writing off loss on realisation of certain investments, now amounts to £337,359; the net revenue is £75,051, and adding the amount brought forward, interest and dividends on investments, and other receipts, the total is £87,089. After deducting debenture charges, preference dividend, &c., £34,978 remains. Out of this, 3 per cent. for the year is paid on the ordinary shares, and £4,978 is carried forward. New connections during the year represent 59,267 (25 C.P.) lamps (1,778 KW.), making the total 1,197,763. In October, Messrs. G. Blackwell, G. A. Moncrieff, and P. D. Tuckett were elected directors, and in January, Lord Avebury, Sir J. Pender, and Mr. Tuckett resigned. Mr. J. S. Highfield has resigned his position as engineer and manager, and has been appointed consulting engineer. Capt. W. R. Rendell has been appointed general manager. Annual meeting: March 22nd.

Metropolitan Electric Tramways, Ltd.

The revenue for 1915 was £513,561. After adding the balance brought forward and deducting all expenses chargeable to revenue, including a provision of £22,715 for reconstruction and renewals, the available balance is £44,275. There is placed to reserve £13,000; preference dividend absorbs £25,000; a dividend of 1 per cent. is to be paid on the ordinary shares, and £1,532 is to be carried forward. £10,275 4½ per cent. and £4,020 5 per cent. debenture stock have been bought and cancelled. The strike in May last caused a loss in traffic receipts of £16,000. Wages will show a material increase as the result of further concessions granted to the staff in December last under an arbitration award. The output of the North Metropolitan Electric Power Supply Co., in spite of the decrease in the number of units supplied for traction purposes, has been satisfactorily maintained; the total units sold were 39,457,712, as against 36,869,118 in 1914. Owing, however, to the abnormal increase in the cost of fuel, the gross profits of the Power Supply Co. for the year show a decrease of £6,340 as compared with 1914. The company is promoting a Bill in Parliament to extend the times limited by certain Acts. Passengers carried 89,656,054, as against 93,325,170; car miles run 9,686,525, as against 11,479,592; average receipts per passenger 1.23d., as against 1.20d. Annual meeting: March 13th.

Notting Hill Electric Lighting Co., Ltd.

Sir W. Crookes, O.M., P.R.S., presiding at the annual meeting on February 29th, said that, notwithstanding the war, the result of the year's work had been satisfactory. The £1,556 spent on capital was almost entirely for meters and mains for new connections. They had only extended the mains where absolutely necessary, and at present they would keep expenditure on new work at the lowest possible figure. The revenue rose by £330, and the expenses by £779. The increase in revenue was partly due to new business and partly to an extra halfpenny per unit charged on the lighting supply during the last nine months. The total cost of generation and distribution advanced by £1,200, although the units sold were 100,000 less. The increase had been partly nullified by decreased management expenses due to Mr. Schultz's retirement; the secretary now combined the offices of manager and secretary. The net result was a drop of £450 in the profit for the year. The balance available for dividends was lower by £1,185, owing to the heavy increase in the income-tax. The total of the Kensington and Notting Hill Joint Debenture Stock sinking fund was £72,920 held in trustee securities. In view of the alarming fall in such securities, owing to the war, they had recently investigated their position in this respect. Owing to the fact that the bulk of the stock purchased was terminable, and was due to be paid off at par at maturity in or about 1931, and that that was the date at which the joint debenture stock had to be redeemed, although present-day prices showed considerable reduction, it would make no difference to the fund, as they would not have to sell the stocks, but just to encash them at par. In the case of the irredeemable securities, of which they had but a small amount, there was a loss estimated at about £1,900, so that they suffered very little by the shrinkage of value. The sinking fund was now being invested in the War Loan. The number of houses connected had risen from 4,293 to 4,358; the units sold fell from 2,539,412 to 2,436,496; the revenue rose from £45,591 to £45,921, and the expenses from £21,370 to £23,304. They had added the equivalent of 4,373 30-watt lamps to the system, and the profit was £22,617, against £24,221. They paid the same dividend as for 1914, but carried forward only £336, as against £655. They had suffered considerably owing to the restricted lighting, and although they had managed to maintain their revenue in the past he was not certain that they would be able to do so this year. When peace was proclaimed their output should largely increase, owing to the removal of restricted lighting regulations and the new lamps that were being constantly added. Expenses must necessarily be high for some time to come, and they were swollen to some extent by increases of wages and payments to employés with the Forces. They had now obtained delivery of the new steam turbine for Wood Lane works; it would save coal, and in a large measure counteract the high price of fuel. The company was doing its share in connection with the war. He hoped that a satisfactory peace would be obtained before their next meeting, and when that time came the company would maintain its prosperity. If the war were prolonged the temporary set-back in their accounts should not be serious. The chairman alluded to the debt of gratitude owing to the special constables who had guarded their stations.

Rushden and District Electric Supply Co., Ltd.—Presiding at the annual meeting, held at Northampton on March 2nd, Ald. F. H. Thornton said that few people realised what go-ahead places Rushden and Higham Ferrers were. The company were supplying many factories and workshops with power. Six boot factories were now completely lighted with electricity. The number of customers had been increased from 79 to 123. The revenue from sale of current had increased from £463 to £1,699, and the output had been doubled. For the first proper working year, he thought the company was doing well in being able to pay 3 per cent. interest.

Minehead Electric Supply Co., Ltd.—The directors report that 1915 was a difficult year. Public lighting restrictions led to a considerable reduction in lighting units sold. There had, however, been a good increase in units sold for heating and cooking, and the total units sold were 230,416, as against 224,629 in 1914. Units generated, 360,079. The average price obtained fell from 3.54d. to 3.40d.; there had also been an increase in cost of materials and working expenses, so that there was some reduction in profit. The result was, however, satisfactory. The profit on trading, after paying debenture interest, &c., was £1,753, plus £145 brought forward. After paying the preference dividend and 8 per cent. on the ordinary (less income-tax), and placing £1,000 to depreciation and reserve, £142 was to be carried forward.

British Electric Traction Co., Ltd.—The directors have declared the dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th. This dividend must be accepted as a payment on account of the dividend on the 6 per cent. cumulative participating preference stock to be issued in place of the 6 per cent. cumulative preference stock of the company upon the confirmation of the scheme of arrangement and reduction of capital by the Court.—*Financial News.*

Bruce Peebles and Co., Ltd.—The total profit for 1915 was £14,916, and after deducting administration expenses, interest on mortgage debentures, and allowing for interest on the unsecured debentures, the net profit is £7,096. Having regard to the abnormal times and difficulties, the results are considered satisfactory. £4,661 has been charged to profit and loss in respect of repairs and maintenance of buildings, plant, and machinery. Annual meeting: March 10th.

W. T. Henley's Telegraph Works Co., Ltd.—The directors recommend a final dividend on the ordinary shares of 10 per cent., less income-tax, making 15 per cent. for the year, and also a bonus of 10s. per share, less income-tax, as compared with 15 per cent. and a bonus of 5s. per share for 1914.

Dublin and Lucan Electric Railway Co.—For 1915 the gross receipts were £7,511, increase £144. Expenditure increased by £208. After providing for debenture interest, £528 is to be carried forward. Payment of the cumulative preference dividend is postponed for the present.

North Metropolitan Electric Power Supply Co.—According to the *Financial News*, the directors recommend a dividend of 6 per cent., with a bonus of 4 per cent., making 10 per cent. for the year. £15,000 is put to renewals reserve, and £6,043 is carried forward.

Midland Electric Corporation, Ltd.—Dividend of 3 per cent. on ordinary shares for 1915. £9,719 is put to depreciation, £4,275 to writing off new issue and construction expenses, and £8,932 is carried forward, subject to excess profits tax.

British Insulated and Helsby Cables, Ltd.—The dividend on the ordinary shares for 1915 is made up to 15 per cent., plus 2½ per cent. bonus. For 1914, 15 per cent. was paid. £98,500 is placed to reserve, and £160,000 carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend of 1¾ per cent. for the three months to March 31st on the common stock.

Manila Electric Railroad and Lighting Corporation, Ltd.—Dividend of 1¼ per cent. for the quarter ending 31st inst. on the common capital stock.

Globe Telegraph and Trust Co., Ltd.—Interim dividend 2s. per share, free of tax, on ordinary shares for the quarter.

Brazilian Traction, Light and Power Co., Ltd.—Quarterly dividend 1¼ per cent. on the cumulative preference shares.

British Electric Transformer Co., Ltd.—Dividend on the ordinary shares 7½ per cent. for 1915.

STOCKS AND SHARES.

Tuesday Evening.

The three principal factors in the Stock Exchange market at present are the battle of Verdun, the calling up of the Derby groups, and the new British War Loan. Such fierceness on the part of the enemy as he is displaying at Verdun is taken as a sign of his desperation to effect something brilliant in order to bring in subscribers to the latest German war issue, and to achieve some success that will cheer his people at home, sick of slaughter as they must be, and growing restive as they are beneath the burdens of taxation and privation. The enrolment of the further Derby groups checks Stock Exchange business from a large part of the community which provides it as a rule; while, as to the third factor, there is no need to emphasise its importance.

Taking them all round, markets are surprisingly firm; and amongst electricity sections, the splendid results secured by the Henley's Telegraph Works and the British Insulated and Helsby Cables Companies have led to further appreciation in the prices of the shares. Electric lighting issues are slightly easier. Falls of ¼ in Brompton ordinary, of ¼ in Charing Cross preference, and of 1/16 in South London shares, are the outstanding movements of the week.

The South London report shows that the company did satisfactorily last year. The sale of current was higher, but gross revenue went down a trifle, and net income, at £27,200, is £2,400 down on the year, net profit being £14,900, or £1,600 less than in 1914. The dividend is maintained at 5 per cent., as already noted; and the carry-forward of £2,000 is about the same as before.

The County of London Electric Supply Co. has issued an excellent report. Gross receipts have risen £24,000 to £298,300, but these were countered by extra expenses, and the net revenue of £159,600 is £4,400 less. The dividend is maintained at 7 per cent., the same as that of the previous twelvemonth; and the carry-forward of £14,500 is £2,000 more than that of a year ago. The report shows that during 1915 supply was commenced in Romford, and that the company is now giving supply in bulk to Sutton, Carshalton, Wallington, and Cheam. Increased expenditure is beyond the power of any management to control at a time like the present, and the County of London shareholders may be congratulated upon the skilful way in which their company is being steered through so trying a period.

The new orders with regard to the lighting of London come into force at the end of this week, but it is not thought that they will have much effect upon the output of the electric lighting companies.

The domestic troubles to which we referred last week, in connection with one of the principal London companies, are made plainer; and it is expected that the meeting of the Metropolitan Electric Supply shareholders may show a "certain liveliness," to quote the Admiralty's classical phrase.

The W. T. Henley Co. has raised its dividend and bonus from 20 per cent. to 25 per cent., and the shares are nominally 10s. higher at 14½. In point of fact, however, it is extremely difficult to get the offer of any shares at all, which, in the circumstances, is not surprising. Having regard to the dividend accrued in the price, the return on the money is getting on for 9 per cent., allowing for the fact that the distribution is made free of income-tax.

The British Insulated & Helsby Cables, Ltd., has declared a dividend of 10 per cent., making 15 per cent. for the year, with a bonus in addition of 2½ per cent.; and here again, although the nominal price is 11, the difficulty is to get the offer of shares. In both concerns the appropriations are large, and assist substantially in fortifying the financial positions of the undertakings.

The market for Manufacturing issues as a whole is naturally a good one, in view of these fine results. British Westinghouse preference recovered 6d. to 44s. 6d., and British Aluminium ordinary are 9d. better, although there is not much change in other shares. India-Rubber ordinary are not affected by the notice just issued to holders of the company's 4 per cent. first mortgage debentures, who can exchange into new debentures, bearing interest at 5 per cent., at the price of 93. Holders of the existing debentures will have the preferential right to take up the new issue, as they are offered £7 per cent. in cash upon their making application to the company. Having regard to the nature of the security, we should imagine that there will be little hesitation on the part of the holders in exchanging their old 4 per cents. into the new fives; and the return of £5 7s. per cent. on the money is raised to 6 per cent. by the new debentures being redeemable at par in 11 years' time.

The various stocks of the Underground Electric Railway companies keep comparatively steady, but attract little attention from investors—speculative or otherwise. It is noticeable, however, that a good many people are picking up low-priced railway stock, particularly that of the District order, regardless of dividends, evidently with the intention of putting it away to await a rise in price (that shall be equivalent to a dividend) after the conclusion of peace.

Underground Electric income bonds at 81¾ are ex their £3 dividend, and the shares are a trifle easier, as will be noticed in our usual list of electricity stocks and shares.

Brazil Tractions have receded to 50½, and the Mexican group is still decidedly dull. British Columbia preferred is rather harder. Of the Colonial issues, Melbourne Electric debenture stock is wanted, and has been done at 95¼. The Anglo-Argentine Tramways group is steady. Rio Tramways first mortgage bonds are firm at 88½, and the seconds are changing hands on the basis of 74.

The telegraph list is unusually free from fluctuation. Indo-Europeans are ½ higher at 49½. Anglo-American Telegraph deferred went back ¼, and this is the sum of the changes on the week. American Marconi's hardened to 15s. 9d. For New York Telephone 4½ per cent. bonds the Government bid is still 100¾. The Eastern group is firm, with little stock on offer; and the Globe issues hold their previous improvements.

The Stock Exchange followed with keen interest the suspension of dealings in the baser metals used in connection with the war, and the Government action in re-establishing the market afterwards came as something of a relief, inasmuch as the House was slightly apprehensive lest the same sort of treatment might be meted out to itself. The copper group is a little heavy. In rubber shares there is continued animation and strength. Business is not on quite as large a scale as it was a fortnight ago, but the rubber market is the busiest section of the Stock Exchange, and all classes of shares are wanted by the speculative investor as well as by the speculator pure and simple.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price March 7, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	—	7	— ½	£7 2 10
Charing Cross Ordinary	5	5	5⅝	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	3½	— ⅛	6 18 6
Chelsea	5	4	3½	—	6 13 4
City of London	9	8	11⅛	—	6 14 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 8
County of London	7	7	17⅜	—	6 15 0
do. 6 per cent. Pref.	6	6	10½	—	5 17 8
Kensington Ordinary	9	7	6	—	7 10 0
London Electric	4	3	1½	—	7 18 0
do. do. 6 per cent. Pref.	6	6	4½	—	7 1 2
Metropolitan	3½	3	2⅜	—	8 4 8
do. 4½ per cent. Pref.	4½	4½	3	—	7 10 0
St. James' and Pall Mall	10	8	5½ xd	—	8 18 10
South London	5	5	3⅛	— 1/16	6 10 9
South Metropolitan Pref.	7	7	1⅛	—	6 14 0
Westminster Ordinary	9	7	5½ xd	—	6 1 9
Telegraphs and Telephones.	Dividend, 1914.				
Anglo-Am. Tel. Pref.	6		100	—	6 0 0
do. Def.	33/6		21½	— ½	7 16 0
Chile Telephone	8		6⅜	—	6 5 6
Cuba Sub. Ord.	5		7⅞	—	6 9 0
Eastern Extension	7		19½	—	*6 5 0
Eastern Tel. Ord.	7		127	—	*6 5 6
Globe Tel. and T. Ord.	6		10⅜	—	*6 10 6
do. Pref.	6		10	—	6 0 0
Great Northern Tel.	22		34½	—	6 7 6
Indo-European	13		49½	+ ½	6 12 6
Marconi	5		1⅛	—	5 8 1
New York Tel. 4½	4½		100¾	—	4 9 4
Oriental Telephone Ord.	10		14⅛	—	5 18 6
United R. Plate Tel.	8		5⅛	—	*7 19 0
West India and Pan.	1		1 1/16	—	9 10 6
Western Telegraph	7		12½	—	*6 5 0
Home Rails.					
Central London, Ord. Assented	4		67½	— ½	5 18 6
Metropolitan	1½		23	+ ½	4 7 0
do. District	Nil		16	+ ½	Nil
Underground Electric Ordinary	Nil		1⅜	— 1/16	Nil
do. do. "A"	Nil		6/-	—3d.	Nil
do. do. Income	6		81½ xd	— ½	*8 9 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6		4⅞ xd	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½		4⅝	—	6 13 6
do. 2nd Pref.	5½		5⅛	—	7 17 2
do. 5 Deb.	5		78	— ½	6 8 2
Brazil Tractions	4		50½	— ½	6 18 7
Bombay Electric Pref.	6		10 xd	—	6 0 0
British Columbia Elec. Rly. Pfce.	5		55	—	9 1 10
do. do. Preferred	—		38	+1	Nil
do. do. Deferred	—		34	—	Nil
do. do. Deb.	4½		64	—	6 19 10
Mexico Trams 5 per cent. Bonds	—		39	- 1	Nil
do. 6 per cent. Bonds	—		35	—	Nil
Mexican Light Common	Nil		22	—	Nil
do. Pref.	Nil		35	—	Nil
do. 1st Bonds	—		41	—1	—
Manufacturing Companies.					
Babcock & Wilcox	14		25⅜	—	5 6 8
British Aluminium Ord.	5		22/9	+9d.	4 8 0
British Insulated Ord.	15		11	+ ½	7 19 1
British Westinghouse Pref.	7½		44/6	+6d.	6 14 6
Callenders	15		11½	—	6 10 5
do. 5 Pref.	5		4½	—	5 17 8
Castner-Kellner	20		7⅛	—	6 8 0
Edison & Swan, £3 paid	Nil		7/-	—	Nil
do. do. fully paid	Nil		1½	—	Nil
do. do. 5 per cent. Deb.	5		80	—	6 6 8
Electric Construction	6		14/9	—	8 1 6
Gen. Elec. Pref.	6		9⅜	—	6 4 8
Henley	20		14½	+ ½	*9 10 1
do. 4½ Pref.	4½		4	—	5 12 6
India-Rubber	10		9½	—	*12 12 0
Telegraph Con.	20		37	—	*7 8 6

* Allowance made for dividends being paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £		No. of weeks.	Total to date. £		Route miles open.	Inc.
Blackpool-Fleetw'd	Feb. 29	1,316	+ 18	8	2,572	+ 128	8	..
Bristol (Trams)	„ 25	17,788	+1,560	8	36,398	+ 2,633	30·5	..
Cork	„ 24	1,791	+ 57	8	3,598	+ 175	54·25	..
Dublin	„ 26	22,817	+1,942	8	46,956	+ 3,082	9·89	..
Hastings	„ 25	2,808	+ 25	8	..	+ 288	19·8	..
Lancashire United	„ 23	6,881	+ 377	8	12,580	+ 829	42	..
Llandudno-Col. Bay	„ 25	758	+ 37	12½	2,333	+ 146	6·5	..
Tyneside	„ 16	2,005	+ 78	7	3,857	+ 14	11	..
Anglo-Argentine	„ 25	199,170	— 975	8	395,241	— 7,666	..	..
Auckland	Jan. 14	22,868	+ 704	28½	148,708	+ 1,612	25·42	1·06
Calcutta	Feb. 26	17,905	+ 602	..	..	+ 1,838	..	..
Kalgoorlie, W.A.	Dec.	3,018	..	..	33,420	..	..	..
*Madras	Feb. 15	1,990	+ 162	6	6,116	+ 761	..	..
Montevideo	Feb.	33,502	+2,494	9	126,466	+ 8,813	..	..
Dublin-Lucan Rly.	Feb. 25	467	+ 10	8	915	+ 5	7	..

Two weeks.

WHAT TO DO WITH OUR CANALS.

By W. N. Stewart.

In the coming trade regeneration of the nation it is certain that a reform of existing methods of internal transport will be a question demanding serious consideration, as present conditions too seriously handicap the business and industries of the country. With railway rates for goods traffic from three to six times greater than similar rates in America and on the Continent, with unused canals and with common roads not utilised to their full value, it is small wonder that British trades have fallen far behind their rivals in the race for commercial supremacy, especially when they have had to compete with nations in which the study of transportation problems has reached the dignity of an exact science.

Before considering the matter which is the subject of this article, let us study the transportation problem as it affects one small community which is typical of thousands of others throughout the land.

The present writer lives in a market town located some 35 miles from Manchester, which, for the purposes of this article, we will call by the name of "X." This town is modern and up-to-date in all its municipal undertakings, has a population of some 18,000, and is both a manufacturing and agricultural centre. Its principal market is Manchester, the great distributing point for Midland trade. "X" is served by a single railway system and by a canal belonging to the railway company, this canal being so little used that it scarcely counts as a factor in the transportation problem. Therefore, the inhabitants of "X" and the towns round about, including several large cities, have to pay toll to the railway on nearly everything they buy, sell or consume, this toll amounting to £2 6s. 8d. on each ton of goods sent, *at owner's risk*, by passenger train to or from Manchester, and from 15s. to 30s. per ton by goods train, according to class of goods. Parcels of limited weight, by passenger train, are delivered in from four to eight hours after sending, while merchandise sent by goods train may arrive in from two to four days after dispatch. To make this situation clearer, it may be fairly considered that it costs as much to send a ton of provisions from Manchester to "X," a distance of 35 miles, as it does to send the same ton from New York to Manchester, a distance of 3,000 miles, that is, at pre-war rates. The charge in the first case is due to the action of a monopoly, while in the second case the seas are free to all, and competition follows the natural law.

How can the canals be best used to reduce these excessive costs, to eliminate the question of monopoly, and to secure the modern requisite of greater speed in delivery?

In the report of the late unlamented Canal Commission, as published in the Electrical Review at the time, it was shown that the best system of canal electrification now in use is one in which rails are laid on the towing path of the canal, electric locomotives supplied with current from generating stations through trolley wires being used to tow boats at a preferable speed of *two miles per hour;* that such a system would cost something like £8,000 per mile to establish, and that an average traffic of at least two million tons per annum would have to be obtained in order to pay expenses. These estimates evidently did not take into full consideration the fact that in many places British canals would have to be entirely reconstructed, as in some places no towing paths exist through tunnels, while to propose a speed of two miles per hour in this twentieth century smacks a bit of the farcical. The principal difficulty, however, was never even considered, and probably was not even discerned, by this sapient Commission, and that is that a canal system, like a railway system, does not do the *whole* work of transportation between the producer and the consumer, but only forms one link in the chain. For example, in order to send a ton of groceries from the wholesale dealer in Manchester to the retailer in "X," the goods must be loaded on a lorry in Manchester, then unloaded at the goods station in Manchester, then loaded on boat or train, then unloaded at "X" goods station, then loaded on a lorry, then unloaded at the premises of the retailer. That is, the ton of groceries has had to be handled *six times* over, and if the transit over the streets of Manchester and "X" has been effected by means of horsed vehicles, this part of the work has cost *more than twice* the cost of that part of the work performed by rail or canal, a cost which, of course, comes out of the pocket of the man who consumes the tea, sugar, or bacon so transported.

There is, however, thanks to the growing understanding of modern methods, a much better system.

Let us at once drain the canals and abolish their use as water-ways. Then pave them for use as motor roads, filling in the locks in such manner as to form gradients not exceeding one in twenty. Let the value of the canals be suitably appraised, and to this value add the cost of necessary alterations, which would not exceed £800 per mile, this sum to be found by the Government. From each vehicle using these roads exact a toll varying with the load capacity of the vehicle, this toll being divided between the owner of the canal and the Government on an equitable scale, thus avoiding an actual expropriation of the canals and giving their owners a substantial income in place of the small return at present obtained. Then confine the use of the canal roads to *electrically propelled commercial vehicles only*, pleasure, passenger, and petrol cars being absolutely excluded. The reasons for this exclusion are that the roads would be intended for commercial purposes only; that it is inexpedient to interfere with the passenger and long-distance goods traffic of the railways; that the scheme is intended to benefit British trades and not to fill the pockets of the Standard Oil or other foreign petrol producers; and, last but not least, because experience in the use of electrically propelled vehicles has conclusively demonstrated the fact that their cost of operation is far below that of petrol cars, and their reliability greater. As the use of the canal should be based on sound economic principles, the cheaper power must be employed. Plenty of statistics are available as to the relative economy of petrol and electrical systems, but with these the present article need not be cumbered.

In the operation of such a system, the Manchester wholesaler would load the electric truck at his warehouse, and using the streets of Manchester, the canal road and the streets of "X," the truck would unload at the door of the retailer in "X," the goods thus being handled *twice* in place of *six* times as at present, while in some cases the retailer would be able to deliver goods to the actual user without any rehandling. During the greater part of the journey from Manchester the vehicle would run on the almost dead level surface formed by the canal bed instead of having to climb the terrible hills prevalent in this part of England, the former condition being almost ideal for accumulator traction. The time of transit from Manchester to "X" would not exceed four hours, giving quicker delivery than is now usually obtained from the passenger train service, while the cost would vary from 6s. to 15s. per ton, in place of the £2 6s. 8d. now paid for small parcels by passenger train, and from 33⅓ to 60 per cent. less than what is now paid for the slow service by goods train.

Another advantage of this proposal is that the Government would in no case be called upon to face an enormous expenditure, such an expenditure being only justified by absolute knowledge in advance that sufficient tonnage would be available to enable the scheme to pay its way. In the scheme above outlined, the heaviest cost—that of the vehicles—would

be borne by the users thereof and be incurred gradually as the economy secured became known, the large firms buying their own vehicles and smaller ones combining on the co-operative system. The Government would, therefore, contribute only the small cost of making the road on a bed already graded. As the roads would be national and free to any electrical commercial vehicle paying the toll, no traffic monopoly could be established, as is now the case at sea. And as Britain's external trade has been built up on this freedom of the seas, which freedom Britain has latterly been at some cost to maintain, so would internal trade be built up by a system of transit which could not be monopolised. This is true because goods would not only be transferred *from* Manchester and other distributing points, but manufactured goods, farm produce, etc., would be carried *to* the distributing and shipping centres, the canal roads forming the arteries of a vast collecting and distributing system, the common roads—reaching every hamlet and every farm in the land—forming the veins.

The effect on the electrical industry would be most salutary. Thousands of workmen would find employment in the construction of motors, vehicles and batteries, while the generating stations, municipally owned or otherwise, would find "peak" loads a thing of the past. In fact, it might prove that the sale of current for lighting would become quite subsidiary to the sale of current for charging accumulators.

But over and above the interests of any one industry, the welfare of the nation should be first considered, and efforts should be made by Chambers of Commerce, municipal authorities, and trade societies in general to show our rulers that *Great Britain now has in existence the finest system of highways in the world*, ready excavated, graded and tunnelled, which can, at insignificant cost and with minimum delay, be made available for the use of the *cheapest known form of traction*, and one which does the *whole job* of transport between manufacturer or wholesaler and retailer or consumer. And not only home trade would get the advantage of these roads: export business would likewise benefit by cheap transit from factory to dock, thus helping to maintain British trade supremacy over seas.

CONTINUOUS-CURRENT RAILWAY MOTORS.

By E. V. PANNELL, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The railway motor is a piece of machinery liable to very severe usage, and its design and construction in accordance with its service conditions form an interesting study.

The object of this paper being to consider general tendencies in design, the curves and tables should be regarded as representative of such tendencies rather than of precise quantities.

In the last few years considerable improvements have been effected in design. In figs. 1 and 2 the dotted curves represent the average weight of the railway motors in general use up to about the year 1909, whilst the full lines show the weights of motors of similar output designed since this date and in operation to-day. The latter are almost all of the commutating-pole type.

Dead-weight is an objectionable feature in the motors where these are suspended directly upon the trucks. The nose form of suspension in general use throws about half the weight of the motor upon the axle without any intervening springs. Moreover, owing to the motor armature rotating from three to four times as fast as the wheels, the energy stored up in it during the accelerating periods will be very considerable, and for this reason minimum weight and armature speed are desirable. A typical calculation for the value of this momentum has been worked out by Mr. F. W. Carter.

A motor introduced in 1910, rated at 48 kw., weighed 2,735 lb., or 800 lb. less than a motor of the same output, but six years older.

This reduction has been secured partly by the increase of rated speed made possible by the adoption of commutating poles, but to a greater extent by the use of more carefully chosen material of higher weight efficiency, and a ventilated structure; moreover, owing to its ventilated design the new motor will have a sustained capacity not less than 50 per cent. in excess of that of the older type of machine.

A closer investigation of the curves in fig. 1 will show the desirability, from the weight-efficiency point of view, of employing a few motors of high capacity, rather than a greater number of low capacity. The total cost is also much less if this is done.

The best practice is to employ the largest motors which can be economically loaded on the lightest service. Rheostats, contactors, reversers, and train cables require to be duplicated for every additional pair of motors; the disparity in costs of the complete equipments is therefore far greater.

The limitations of linear dimensions are of even more strict a nature than those governing the weight. On the standard rail-gauge of 4 ft. 8½ in. the maximum distance between the inside of the wheel flanges is 52 in., which positively limits the length of the motor casing. In the other direction the wheel diameter is the limiting feature; the size in use on the majority of electric suburban, elevated, and subway railways is 33 in. Recently there has been a more liberal tendency in this direction, and wheels of 36 in. to 42 in. will become standard except where tunnel limitations are too severe. With the 33-in. wheel the maximum armature diameter is 20 in., and the maximum practical length of core for a 600-volt motor of about 200-kw. rated capacity is about 15 in.

In fig. 3 curve A represents a series of interpole designs worked out by the author, whilst the points indicated refer to machines in actual service. The step at the end of the curve relates to motors with duplex gears. It is interesting to compare the curve relating to railway motors with that plotted for stationary machines; the great disparity is due mainly to the system of rating employed.

Railway motors, being invariably series wound, attain high rotational speeds at light loads; the free-running speed in service usually coincides with about one-third the rated load, and is nearly double the rated speed. 600 r.p.m. is a good average value for satisfactory designs.

In general the efficiency of the high-speed motor is better at rated load and inferior at light loads as compared with the lower-speed design.

Practically all motors of 100 kw. and over are designed for one armature turn per segment in order to reduce the reactance per coil, but even with the most careful design the reactance voltage at rated load is of the order of 9 or 10, or four times that of a reasonably good generator.

A device which has found universal adoption is the grooving out of the commutator mica to a depth of about 1/16 in. below the surface of the copper. This avoids any trouble due to high mica and has a remarkable effect in keeping the commutator surface clean and cool. With the hard carbons in common use centrifugal force is found quite sufficient to keep the slots free from particles.

Commutating-pole motors are now being regularly supplied with 2,400-volt insulation and 1,200-volt commutators for running two in series on a 2,400-volt line. The broad advantage obtained by the use of interpoles is the greatly reduced chance of flash-overs. The reactance voltage being practically neutralised and the sparking proportionately lessened in severity, there remains little to start an arc from brush to brush or to frame. The commutating-pole machine therefore becomes a stronger type of motor, capable of heavier short-time overloads and higher speed and voltage, whilst its maintenance charges are greatly reduced.

It is found that the traction motor is no larger and, as already seen, is lighter than the pre-interpole machine. On the Moselhütte mineral line in Lorraine, the locomotives are operated at 2,000 volts, the pressure on each motor being 1,000 volts. The gauge of the line is only 39½ in., notwithstanding which it has been found possible to equip the locomotives with motors rated at 120 kw., the armatures being of 26 in. diameter with a core length of only 6¼ in.

It is frequently the case that a certain type of motor will be called upon to perform widely different classes of service, possibly interchanging local service with as many as two stops per mile with express schedules running five miles or more without a stop. The use of sectional or tapped field control affords one method of effecting the compromise and operating a system of diverse characteristics with one type of motor. More valuable still is the use of field control for notching up on the controller during acceleration. A motor designed for this principle will probably have at its full field a speed 10 per cent. lower than the average machine, whilst with the short field this speed is increased by some 25 per cent. The motor is thus able to run upon either of two speed curves at the will of the motorman.

The commutating characteristics are so improved in the interpole machine that reduction of the main field by 50 per cent. does not appear to affect the collection of current. Typical speed curves for a field-control motor are shown in fig. 4.

Speeds of 450 r.p.m. for the rated load speed at full field, and 550 or 600 at short field, are typical of what has been found most satisfactory practice for a 200-kw. motor. Too great a disparity in the speeds at any given armature current leads to a pronounced current "kick" when changing, and would probably tend to induce flashing over.

The field-control motor provides a shorter rheostatic period and a much longer period of motor speed-curve running. The lower the full-field speed of the motor the quicker will the rheostats be cut out, and the less the rheostatic losses for a given acceleration rate. On one of the suburban railways in Christiania, Norway, the field windings of the 1,200-volt motors are not only divided for short and full fields, but are grouped for series and parallel connections. This gives four different running speeds all with the motors directly on the line. By this means nearly half of the controller notching may be performed free of rheostats, and a good approximation to alternating-current tapped-transformer control is effected. The mere tapping-off from a single point near the middle of the field winding is becoming standard practice, however, in view of the simplicity of the necessary controller connections.

The overall efficiency of a motor allows for losses in the copper, core, and commutator, together with gear and bearing friction and windage. As factors in the temperature rise, all

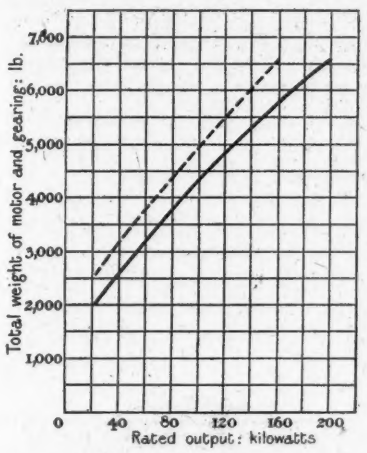

Fig. 1.—Weights of Continuous-current Railway Motors at 600 r.p.m. Rated Speed.

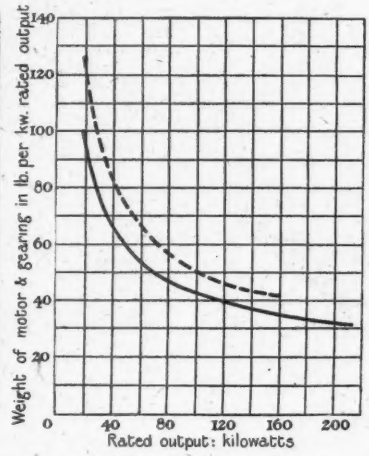

Fig. 2.—Unit Weights of Railway Motors corresponding to Fig. 1.

but the gear losses are effective. In the short 1-hour heat run these are absorbed in the mass of the machine, there being little radiation with heavy motors. The output of a railway motor at rated load is, however, being superseded as a criterion of its service capacity. What is far more important than the 1-hour rating is the capacity for continuous operation of five or six hours or even longer periods.

From the curves in fig. 5 it will be seen that although two different machines may have exactly the same rated 1-hour output, efficiency, and possibly weight, their performance on runs of longer period is radically different. Motor A will take much heavier loads to reach its 75 deg. C. rise than motor B for two, three, or four hours' running. The former is representative of the recent ventilated designs, and the latter of the totally enclosed carcass motors which are only

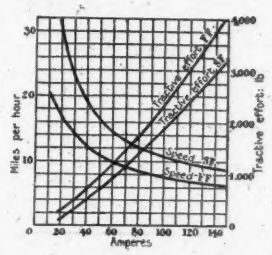

Fig. 4.—Speed and Tractive-effort Characteristic for a 45-kw. Motor on Short (S F) and Full (F F) Fields.

just being superseded by type A. The heating in actual service may be assumed to be some 15 per cent. lower on account of the positive draught produced by the motion of the train.

In fig. 6 are shown the approximate values of the losses in a 180-kw. railway motor, and fig. 7 shows the thermal characteristic of the same machine running on stand test. The preponderating factor in the temperature rise at rated load is the copper loss, and at light loads the core and stray losses; consequently a motor for frequent stops and accelerating service should be designed with a view to the lowest possible copper loss, whilst the machine which is expected to run for one or more hours continuously at about one-third rated load should have the lowest possible core loss in order to operate within its temperature limitations.

It is impossible to specify for a railway motor on the basis of its 1-hour rating alone. Specifications should call for the value of the various losses at two or three different loads, particularly for the average load at which the motor is expected to operate in service.

The basis of both the American and European methods of rating railway motors is the 75 deg. C. temperature rise in a 1-hour run on the test bed with covers removed and no artificial ventilation. Without having been standardised in England, this system is in very general use here and might quite well be officially adopted. It is usually recognised that the 1-hour rating represents the maximum desirable current input for acceleration, and that the average load for a complete day's running should not exceed 30 per cent. rated load for

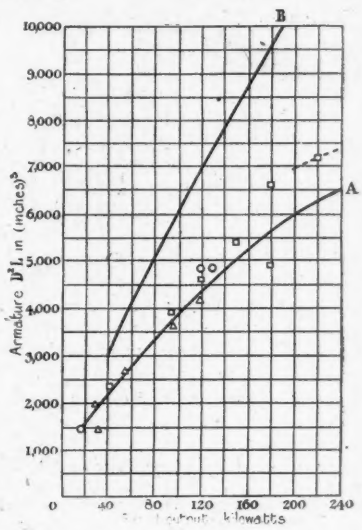

Fig. 3.—Relation of Output to Dimensions of Armature.

Curve A: Geared railway motors, 600 r.p.m.
Curve B: Hobart's curve for d.c. machines, 600 r.p.m.
○ indicates British, □ American, and △ Continental designs.

unventilated, or 50 per cent. rated load for ventilated, machines.

In more than one instance on electric railway systems in America ventilated motors rated at 50 kw. are doing the same work as the 80-kw. non-ventilated machines which they have superseded, with a net saving of 50 per cent. on the equipment weight and of 30 per cent. on its cost. Ventilated motors have been found to operate satisfactorily even under the most adverse circumstances of dusty and gritty ballast.

In recent designs radial ducts in the core have been quite abandoned in favour of longitudinal passages. Recently, multiple fans have been introduced by which the air is all

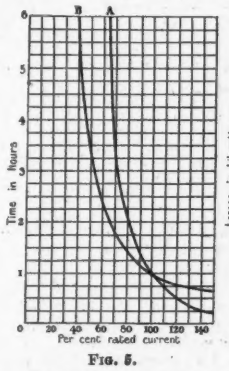

Fig. 5.

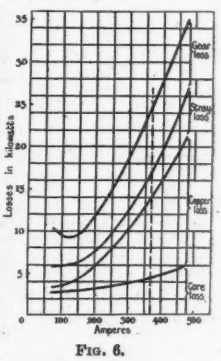

Fig. 6.

Fig. 5.—Time taken to attain 75 deg. C. Temperature Rise on Hottest Accessible Part.
(A) Ventilated; (B) Non-ventilated motors.

Fig. 6.—Losses in a 180-kw. Motor.

drawn in at one end of the carcass through all the passages in parallel and expelled at the other end.

The air circulation is effected by an exhaust fan of very compact type, usually of aluminium or pressed steel, which is bolted to the armature core and actually forms the end core-plate. The velocity imparted to the air is sufficient to retain in suspension any dust which might enter the casing and to carry it out again. The drawback to the earlier semi-ventilated motor was that no positive velocity was given to the air, and also that the structure of the machines provided dead-ends and pockets into which the dust, grit, iron oxide, and other particles were driven and permitted to accumulate. The present type of motor with its strong induced draught

and clean-cut and direct air passages overcomes these drawbacks entirely.

Forced ventilation by means of air compressors does not seem to be justified except where it is required to force the output of a motor beyond that obtained by internal ventilation. The device is at present almost wholly confined to locomotives.

The increase in rated voltage to values higher than 600 followed immediately upon the introduction of commutating poles into railway-motor design; commutation was thereby so much improved that an increase of 100 per cent. in the average volts per commutator segment was found permissible.

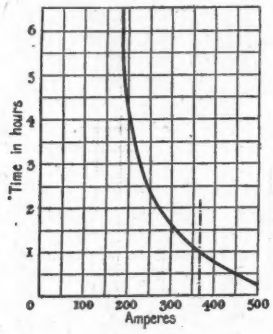

Fig. 7.—Thermal Characteristic of 180-kw. Motor (see fig. 6) for 75 deg. C. Temperature Rise.

The practicability of pressures of 1,200 or 2,400 volts has greatly broadened the limits of continuous-current working. Where these high pressures are employed it is generally for fairly heavy service of the interurban or extra-suburban order demanding powerful motors; this is a favourable feature, as in common with other classes of electrical machine the high-voltage traction motor becomes a more economical proposition with increasing outputs. There is a perfectly definite limit to the pressure which can be applied to the motor terminals, and this would appear to be about 2,000 volts for car motors of the type under review.

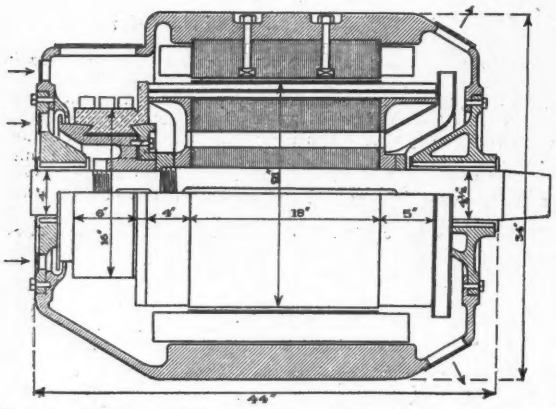

Fig. 8.—Section of 200-kw. 1,200-volt Ventilated Motor for Field Control.

With increased voltage the current to be commutated is reduced, consequently the commutator can be shortened in almost the same proportion. Every inch by which the commutator is reduced may be added to the core length, thus immediately securing an increase in the effective flux passing through the armature. This very nearly compensates for the reduced armature loading consequent upon the low space factor in the slots, and leads to the conclusion that with given dimensions the higher-voltage motor needs to be designed for a stronger field and weaker armature. This is just the tendency required for a satisfactory design.

The two limits governing commutator design in high-pressure motors are the maximum permissible voltage per segment and the minimum segment width. The minimum allowable width of bar including mica is about 0.16 in., the limiting desirable average voltage per segment is believed to be 20 for a reasonably good field distribution.

If these conditions are complied with, the design and manufacture of a satisfactory 1,200-volt motor is a simple matter, and that of an 1,800-volt machine, whilst being a slightly more heavy and costly proposition, is very little more so. Higher pressures than this do not seem necessary in view of the practicability of connecting groups of two or four motors permanently in series.

The same motor carcass which will give 200 kw. at 600 volts will yield 180 kw. at three times this potential. Fig. 8 shows a longitudinal section of the 1,200-volt motor.

CHATTERING WHEEL SLIP IN ELECTRIC MOTIVE POWER.

A paper on this subject was read at the Midwinter Convention of the American Institute of Electrical Engineers, New York, by Mr. G. M. Eaton, of which the following is an abstract:—

The fundamental difference between the running gear of steam and electric motive power is that in the steam locomotive, the only moving parts having relatively high moment of inertia are the driving wheels.

In an electric locomotive, the moment of inertia of the rotors, especially when operating through a gear reduction, may be as great as or greater than that of the driving wheels.

The combined inertia of connecting rods, cross-heads, piston rods and pistons is practically negligible in so far as it affects acceleration of driving wheels after slipping starts. In an electric locomotive, when slipping occurs, the sequence of events is as follows, regardless of the type of drive:—

Current is applied to the motor and the rotor starts to turn. Clearances in the entire transmission mechanism are first eliminated. Then, as the torque is increased, the metal of the transmission, framing, &c., is bent and twisted, or otherwise deflected. This stressed metal becomes a storage battery of energy. Finally the tractive effort reaches a value sufficient to overcome the existing adhesion at the rail (coefficient of friction of repose), and the wheel starts to slip. The instant relative movement occurs between wheel and rail, the coefficient of friction drops from that of repose to that of relative motion. There is, therefore, an opportunity for the stressed metal to start discharging its stored energy, since part of the resisting force has disappeared. This energy is expended in

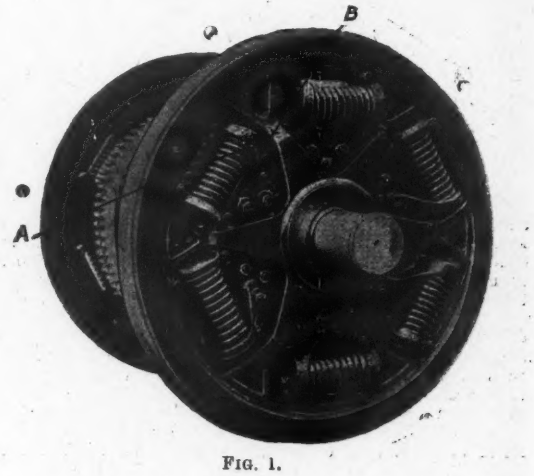

Fig. 1.

accelerating the wheels ahead of the angular position they occupied relative to the rotor at the instant slipping started.

It is necessary next to analyse independently the two divisions of the rotating system, namely, rotors and wheels.

Since the wheels are being accelerated ahead of the rotors, the rotors are losing their load and will tend to speed up. This is true not only of motors of series characteristic, but also of induction motors when running below synchronism, as will ordinarily be the case in traction work when the wheels slip. In fact, the induction motors, because their generated counter E.M.F. with increased speed is less than with series motors, will hold up their torque better and, therefore, accelerate faster.

Analysing next the other division of the system, the adhesion at the rail will decrease as the velocity of the wheel tread relative to the rail increases. The effort being transmitted through the transmission system, however, will decrease very rapidly, due to expenditure of stored energy, and as soon as this effort, which is tending to accelerate the wheels, becomes less than the adhesion at the rail, which is tending to retard the wheels, the wheels will evidently start to slow down.

There are, then, two sets of rotating masses mechanically coupled, the masses at one end of the system accelerating, and those at the other end retarding. As soon as clearances in the transmission are taken up, there is liable to be a jolt on the mechanical system, accompanied by a recoil. This gives the setting for chattering action, and such action has been experienced in practically every type of electrically-driven rolling stock where the motors are sufficiently powerful to slip the wheels at high adhesion.

In the case of a geared freight and passenger locomotive, the quill arms at the point marked A hit against the wheel spokes at the point marked B (fig. 1), and more or less break-

age of these arms occurred, but this was traced to defective castings.

In later locomotives in the same service equipped with two motors per axle, the change in armature inertia eliminated this striking.

The same characteristic is occasionally observed in city and interurban cars, although this is much less frequent than in heavy hauling electric locomotives.

In the case of freight locomotives where the motors are geared directly to the axles the same phenomenon has been observed.

On the Norfolk and Western locomotives, chattering slip occurred in the running gear shown in fig. 2. After the locomotives had been in service for some months, evidences of failure were detected in the crank pins. The cause was traced to chattering slip by means of a rough oscillograph. The brakes were set on three trucks, and the oscillograph frame

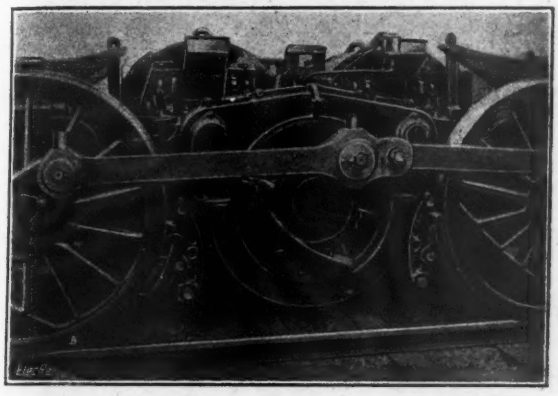

Fig. 2.

was set up on the fourth truck. The characteristic diagram of the chattering slip was obtained, as shown in fig. 3. The analysis in the figure is self-explanatory.

To check the oscillograph figures, extensometers were arranged, as shown in fig. 4, by means of which the connecting rods indicated their own stresses. The extension and compression of the rods were recorded by means of the compression of blocks of lead.

The two methods checked within a very few per cent. On the basis of the results, new rods, pins, &c., were applied on the locomotives. These have proved adequate for the service.

This chattering slip was more evident on the Norfolk and Western locomotives than could have been anticipated, since this was the first time electric haulage had been applied in service where such extremely high tractive efforts were required.

In all heavy hauling electric motive power, this problem must be considered, with every type of drive. The great number of variables entering and the wide fluctuation of certain of these variables render broad experience necessary in securing a successful solution of the problem.

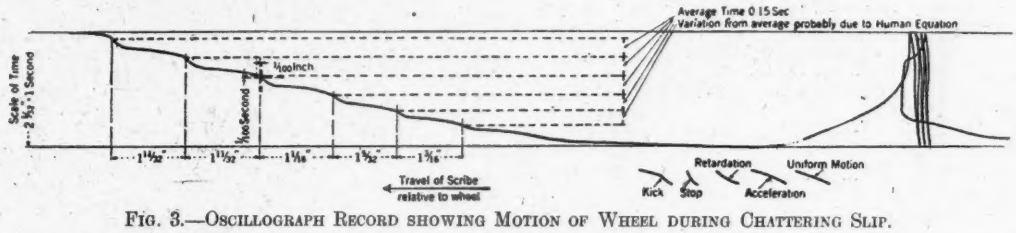

Fig. 3.—Oscillograph Record showing Motion of Wheel during Chattering Slip.

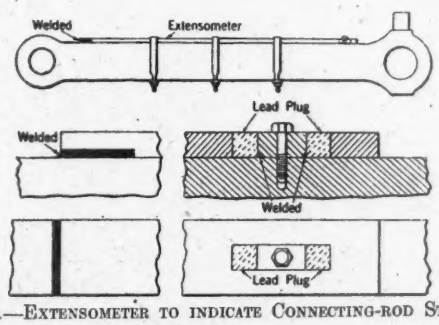

Fig. 4.—Extensometer to indicate Connecting-rod Strains.

IMPORT TRADE OF CEYLON.

The following figures, showing the value of the imports of electrical and allied material into Ceylon during 1914, are extracted from the recently-issued official statistics. The values for the previous year are given for purposes of comparison, and notes added of any increases or decreases:—

	1913. Rupees.	1914. Rupees.	Inc. or dec. Rupees.
Manufactures of copper.—			
From United Kingdom ...	45,000	30,000	– 15,000
,, India	33,000	29,000	– 4,000
,, Germany	45,000	22,000	– 23,000
,, Other countries ...	5,000	1,000	– 4,000
Total	128,000	82,000	– 46,000
Electrical materials.—			
From United Kingdom ...	209,000	160,000	– 49,000
,, Germany	15,000	5,000	– 10,000
,, Other countries ...	14,000	16,000	+ 2,000
Total	238,000	181,000	– 57,000
Scientific instruments.—			
From United Kingdom ...	31,000	19,000	– 12,000
Lamps.—			
From United Kingdom ...	140,000	135,000	– 5,000
,, Germany	105,000	72,000	– 33,000
,, Other countries ...	39,000	26,000	– 13,000
Total	284,000	233,000	– 51,000
Machinery, foundry and workshop.—			
From United Kingdom ...	1,075,000	651,000	– 424,000
,, United States ...	15,000	12,000	– 3,000
,, Other countries ...	5,000	2,000	– 3,000
Total	1,095,000	665,000	– 430,000
Other machinery, dutiable, not including tea, textile, and oil-making.—			
From United Kingdom ...	53,000	41,000	– 12,000
,, Germany	2,000	2,000	—
,, Other countries ...	3,000	3,000	—
Total	58,000	46,000	– 12,000
Ditto, free.—			
From United Kingdom ...	1,407,000	696,000	– 711,000
,, Germany	145,000	96,000	– 49,000
,, United States	78,000	50,000	– 28,000
,, Other countries ...	105,000	30,000	– 75,000
Total	1,735,000	872,000	– 863,000
Telephone materials.—			
From United Kingdom ...	43,000	6,000	– 37,000
,, Germany	—	1,000	+ 1,000
Total	43,000	7,000	– 36,000
Railway carriages and trucks.—			
From United Kingdom ...	6,000	6,000	—
Rails and fishplates, &c.—			
From United Kingdom ...	83,000	58,000	– 25,000
,, Other countries ...	17,000	2,000	– 15,000
Total	100,000	60,000	– 40,000

(N.B.—15 Rupees = £1.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SIERRA LEONE.—A Sierra Leone Ordinance has been passed imposing increased duties on certain articles imported into the Colony, with effect from January 1st, 1916. Electrical machinery and apparatus (and all parts and appliances thereof) consisting of a combination of moving parts or mechanical elements which may be put in motion by physical

or mechanical force, and admitted as such by the Collector of Customs, remain free of duty; the duty on all other electrical apparatus has, however, been increased from 12½ per cent. *ad valorem* to 15 per cent. *ad valorem*.

SWEDEN.—The exportation of the following, among other articles, has been prohibited from Sweden as from January 18th:—Asbestos, unworked; manufactures of asbestos, not specially mentioned; insulating compositions (for protection against heat or cold) with or without admixture; also manufactures of such insulating compositions, such as slabs, segments, and other shaped pieces.

FRENCH INDO-CHINA.—A concession which cannot fail to be of the greatest assistance to British traders who export goods to Indo-China has recently been announced. Hitherto, British goods, in order to obtain the benefit of the "Minimum" Tariff rates on importation into Indo-China, have had to conform to the condition that the goods be transported *direct* to that country. The official announcement, however, states that as an exceptional measure, and for the period of duration of the war, goods of British origin will be entitled to the "Minimum" rates *even if the goods are transhipped en route* at Singapore, subject to the production of certificates of origin as required by the regulations.

MOROCCO.—The Board of Trade have received a copy of a Tariff showing the valuations of the principal articles of merchandise imported into Morocco. These valuations form the basis on which duty is to be assessed by the Moorish Customs Administration during the first half of 1916. It should be remembered that, with certain exceptions, goods imported into Morocco by sea are subject to duty at the rate of 10 per cent. *ad valorem*, and also to the special tax of 2½ per cent. *ad valorem* imposed as a temporary measure by Article 66 of the Algeciras Act. The new valuation tariff may be inspected at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

UNITED STATES OF AMERICA.—The following decision respecting the application of the United States Tariff Act of 1913 has recently been rendered by the Board of General Appraisers:—

Metal Flash-light Cases.—The outer casings of electric flash-lights, composed wholly or in chief value of metal, lacking only batteries and light bulbs to render them complete articles, valued above 20 cents (10d.) per dozen pieces, are not like articles to those enumerated in paragraph 356 of the Tariff, and are, therefore, not within that paragraph. They are properly dutiable as manufactures of metal not plated with gold or silver, under paragraph 167 of the Tariff, at the rate of 20 per cent. *ad valorem*.

VENEZUELA.—In virtue of a Presidential Decree, dated December 17th, 1915, pocket and portable electric lamps when imported into Venezuela are to be declared in the Consular Invoice, and to pay duty, as follows:—

Declaration for Consular invoice.	Class of the Tariff under which dutiable.	Total import duty (including surtaxes).
Lámparas eléctricas portatiles y de bolsillo	IV, plus 30 p.c. specific.	1.526 bolivares per kilog. (gross).

It is important to preserve the exact (Spanish) wording shown above in the "Declaration for Consular Invoice." (Bolivar = 9.6d.; kilog = 2.2046 lb.)

GAMBIA.—A new Customs Ordinance (No. 21 of 1915) came into force on January 1st, 1916, in the Colony of the Gambia, which makes provision for the levying of import duties differing in many instances from those formerly in operation. Among the articles *exempted* from import duty may be mentioned electrical plant and apparatus, and industrial and manufacturing machinery for use in connection with the preparation of any natural product of West Africa, and spare parts imported at the same time; scientific and surgical instruments and apparatus; telegraph materials imported for the use of the African Direct Telegraph Co. The duty on all goods not specified and not exempted from duty has been increased from 5 per cent. to 7 per cent. *ad valorem*.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

2,536. "Carbon electrodes." H. Levy. February 21st.

2,546. "Electrically-operated valves." E. C. St. John. February 21st.

2,547. "Dynamo-electric machinery." Lancashire Dynamo and Motor Co. and H. B. Whitmore. February 21st.

2,551. "Thermostats for attaching to urns, mullers, &c." E. L. Bernard. February 21st.

2,552. "Miners' electric hand lamps." A. E. Angold & A. H. Railing. February 21st.

2,556. "Electrode holders for electric welding." Quasi-Arc Co. & A. P. Strohmenger. February 21st.

2,569. "Dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 21st.

2,576. "Remote control of search-lamps and ordnance." J. Brockie. February 21st.

2,580. "Telephone systems." Relay Automatic Telephone Co. & H. J. Herink. February 21st.

2,582. "Dynamo-electric machines." R. V. Morse. February 21st.

2,584. "Electric furnace." W. J. Wrightson. February 21st. (United States, February 19th, 1915.)

2,598. "Devices for generating, in an aerial for wireless telegraphy and telephony, electric oscillations having a strictly single frequency." E. Bellini. February 21st.

2,600. "Ampere-hour meter with friction-compensating device." Landis and Gyr. Soc. Anon. February 21st. (Germany, February 22nd, 1915.)

2,609. "Means for completing the connection of tubular electrical conductor conduits to switch boxes, &c." H. W. Cox. February 22nd.

2,615. "Electric heating apparatus." J. H. Farthing & M. J. Railing. February 22nd.

2,616. "Electrical ignition apparatus for starting internal-combustion engines." M. S. Conner. February 22nd.

2,639. "Amplifying electrical variations." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 22nd.

2,641. "Projector arc lamps." J. Brockie. February 22nd.

2,660. "Automatic telephone exchange systems." C. A. W. Hultman. February 22nd. (Sweden, February 23rd, 1915.)

2,672. "Shading electric, &c., lights." J. W. Anderson & L. Loukes. February 23rd.

2,681. "Terminals of electrical machinery, &c." F. J. Hadfield. February 23rd.

2,697. "Automatic electric fog signals." W. A. Jeboult & H. J. S. Stobart. February 23rd.

2,701. "Ignition dynamos." C. T. Mason. February 23rd. (United States, March 15th, 1915.)

2,704. "Manufacture of electric incandescence lamps with metallic incandescence body." Deutsche Gasglühlicht Akt. Ges. (Auerges). February 23rd. (Germany, May 4th, 1915.)

2,714. "Elastic fluid turbines." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 23rd.

2,725. "Electrical impulse responders or selectors." H. J. Herink & Relay Automatic Telephone Co. February 23rd.

2,752. "Fire bars for electric heaters." A. S. Blackman & S. R. Windle. February 24th.

2,756. "Means for attaching flexible conductors to electrical apparatus." W. H. Sturge. February 24th.

2,780. "Electrolytic processes and apparatus." F. W. Gauntlett. February 24th.

2,857. "Electric ignition of internal-combustion engines." C. W. Tidmas. February 25th.

2,858. "Electric ignition of internal-combustion engines." C. W. Tidmas. February 25th.

2,861. "Receivers for wireless signals." Marconi's Wireless Telegraph Co. & F. P. Swann. February 25th.

2,864. "Fluid flow meters." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 25th.

2,891. "Telephone receivers." G. A. Nussbaum. February 26th.

2,895. "Telephone transmitters." E. A. Petithory. February 26th.

2,896. "Electrical sounders, hooters, &c., for telephones." E. A. Laidlaw. February 26th.

2,901. "Measuring instruments." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 26th.

PUBLISHED SPECIFICATIONS.

1914.

17,851. Electric Transformer Motors. D. Suchostawer. July 28th. (February 13th, 1915.)

1915.

1,774. Apparatus for Electrically Operating Planing Machines and the like Reciprocating Tools. Lancashire Dynamo & Motor Co. and W. Hargreaves. February 4th.

2,045. Electric Accumulators. J. P. Haworth. February 9th.

2,180. Electric Switch Panels. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). February 10th.

2,226. Steam Accumulators. British Thomson-Houston Co. & C. H. Naylor. February 11th.

2,356. Means for Intermittently Starting and Stopping as desired Electrical Machines. W. Brown. February 15th.

2,390. Electricity Meters for Multi-wire Circuits. F. A. Nield. February 15th.

2,489. Portable Electric Lamps. H. J. C. Forrester (J. W. Dunham). February 16th.

2,786. Electric Transformers. J. Torner. February 20th. (February 21st, 1914.)

2,894. Heating Tools or Dies by Electricity. W. J. Readett. February 23rd.

3,366. Telephone Exchanges. International Electric Co., R. G. le Noir and E. Funccius. March 2nd.

4,110. Means for Connecting Electrical Conduits to their Fittings. F. L. Broughton. March 16th. (Cognate application 4,885/15.)

4,681. Apparatus for the Electrolytic Production of Zinc. M. Perreur-Lloyd. March 25th. (May 28th, 1914.)

6,642. Combined Electric Switches and Connecting Plugs. R. Moore. May 4th. (Cognate application 8,736/15.)

7,003. Method of and Device for Kindling Mercury Vapour Electric Apparatus. Quarzlampen G.m.b.H. May 10th. (June 15th, 1914.)

7,622. Electric Lamps as applied for Advertising Purposes. W. C. Jeans and Jeans, Ltd. May 21st.

7,868. Rontgen or X-ray Apparatus. C. B. Burdon (Siemens & Halske Akt Ges.). May 27th.

8,272. Arc Lamp with Electrodes of Highly Refractory Metals, Tungsten in particular. Allgemeine Elektricitäts Ges. June 3rd. (June 3rd, 1914.)

8,412. Electrical Safety Fuse Devices. C. B. Burdon (Siemens & Halske Akt. Ges.). June 7th.

9,246. Electric Relay. W. R. Sykes Interlocking Signal Co. & G. H. Sykes. June 23rd.

14,548. Electro-mechanical Driving Arrangements for Vehicles and other purposes. H. Reik & Oesterreichische Daimler-Motoren Akt. Ges. October 14th. (September 2nd, 1913.)

15,750. Process for Electrolytically Reducing or Oxidising Organic Substances. O. Imray (Society of Chemical Industry in Basle). November 8th.